Risk perception and commitment to reduce global climate change in Spain

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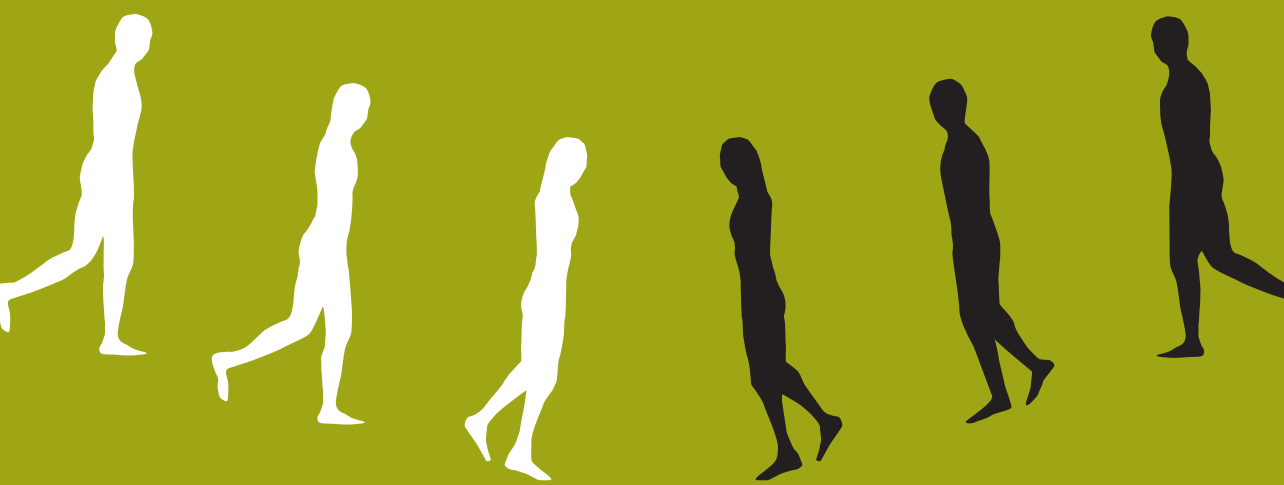

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RISK PERCEPTION AND COMMITMENT TO REDUCE GLOBAL CLIMATE CHANGE IN SPAIN

PERCEPCIÓN DEL RIESGO Y COMPROMISO POR REDUCIR EL CAMBIO CLIMÁTICO GLOBAL EN ESPAÑA

Nuria Rodríguez-Priego nrpriego@ugr.es
University of Granada. Spain

Francisco J. Montoro Ríos fmontoro@ugr.es
University of Granada. Spain

Nikolaos Georgantzís georgant@eco.uji.es
University of Reading & LEE, Universitat Jaume I. Spain

Abstract
An online national survey among the Spanish population (n = 602) was conducted to examine the factors underlying a person's support for commitments to global climate change reductions. Multiple hierarchical regression analysis was conducted in four steps and a structural equations model was tested. A survey tool designed by the Yale Project on Climate Change Communication was applied in order to build scales for the variables introduced in the study. The results show that perceived consumer effectiveness and risk perception are determinant factors of commitment to mitigating global climate change. However, there are differences in the influence that other factors, such as socio-demographics, view of nature and cultural cognition, have on the last predicted variable.

Keywords
Cultural Cognition Theory; Global Climate Change; Perceived Consumer Effectiveness; Risk Perception.

Resumen
Una encuesta *online* a la población española (n = 602) examina los factores que predicen el apoyo al compromiso con el medio ambiente por parte de los participantes para reducir el cambio climático global. Se realizó una regresión múltiple jerárquica en cuatro pasos y se testó el modelo de ecuaciones estructurales propuesto. En la encuesta se aplicó una herramienta diseñada por el Yale Project on Climate Change Communication con la finalidad de construir escalas para las variables introducidas en el estudio. Los resultados muestran que la efectividad percibida por el consumidor y el riesgo percibido son factores determinantes del apoyo al compromiso para reducir el cambio climático global. No obstante, se encontraron algunas diferencias en cuanto a la influencia de otros factores tales como las variables socio-demográficas, la visión de la naturaleza y la cognición cultural.

Palabras clave
Cambio Climático Global; Efectividad Percibida del consumidor; Percepción del riesgo; Teoría de la Cognición Cultural.

Introduction*

Humans have been exposed to many threats throughout history: epidemic illnesses, world wars, terrorist attacks, and environmental catastrophes. Human's survival instinct forces people to evaluate circumstances and make decisions when faced with risks. Many different factors determine the resulting choices, including emotions, positive and negative feelings, past experiences and cognition (Peters and Slovic 1996; Finucane et al. 2000a; Loewestein et al. 2001).

Global Climate Change is a reality that has been acknowledged by scientists for several decades. Moreover, the Intergovernmental Panel on Climate Change (IPCC) reports a clear scientific view on the current state of the earth´s climate and its potential environmental and socio-economic impacts. Although human action is not the sole cause of the changes that have taken place, future climate change caused by humans could trigger additional increases in greenhouse gases in the atmosphere and hence global warming (Stern 2006).

International governments are starting to consider environmental threats as an actual source of danger. The European Union has developed a climate strategy related to the European Climate Change Programme (ECCP), which advocates specific control measures to limit temperature increases to 2°C above pre-industrial levels by 2020 —Commission of the European Communities (2007). The evolution of EU environmental policy includes the progressive introduction of economic growth that is compatible with sustainability, environmental protection and social cohesion (Aguilar 2003).

More specifically in Spain, a legislative strategic framework has been established, including the *Spanish Strategy for Climate Change and Clean Energy 2007-2012-2020*, which calls for the implementation of projects to reduce climate change and encourage the use of clean energy, while promoting social welfare, economic growth and improved environmental protection. Furthermore, global climate change is the principle environmental concern of regional populations in Spain, and is linked to concerns about specific, local problems, such as rising temperatures, altered precipitation, increased desertification and soil erosion (Moyano, Paniagua and Lafuente 2009).

Political actions may be influenced by what citizens perceive as risks (Slovic 1997), and the importance of climate change risk perception rests on how policymakers are influenced by two different stakeholders: scientists and the lay public. Despite the evidence for climate change, both scientists and lay people may be subject to the same problems when they make judgments since cognitive limitations affect their beliefs and contribute to disagreements (Kahneman, Slovic and Tversky 1982). Additionally, environ-

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mental consciousness can be manifested through an increased understanding of environmental policy measures (Jiménez Sánchez and Lafuente 2010).

Risk perception has been previously examined from several perspectives and fields of research. Psychological, anthropological and sociological studies have identified well-known paradigms. Many past studies on risk perception have focused on climate change (Bord, Fisher and O´Connor 1998; Dunlap 1998; Stedman 2004; Leiserowitz 2006) and natural disasters (Ho et al. 2008). Results show that the risk people perceive from their environment is highly influenced by the characteristics of the potential source of danger, but also by gender, race, ethnicity, socioeconomic status (Flynn, Slovic and Mertz 1994; Finucane et al.2000b; Lerner et al. 2003) Lerner et al. 2003), and even culture (Dake 1991; Sjöberg 1996; Douglas 1998:98; Poortinga, Steg and Vlek 2002; Rippl 2002).

This paper focuses on global climate change as an environmental threat; specifically, it measures the perceived risk global climate change generates and analyzes how that risk is shaped, while also attempting to predict how individuals would increase their support for policies that protect the environment. Therefore, the aim of the present study is twofold: (1) to analyze the factors determining the perceived risk of global climate change; and (2) to examine whether these factors have an influence on support for the efforts of the Spanish government, corporations and citizens in order to reduce negative impacts on the environment.

Literature review

Risk perception

The concept of risk perception is a psychological construct based on a variety of sources of information and subjective judgments concerning the perceived likelihood of a hazard. Often in these situations, objective information is minimal and heavily influenced by internal factors that can be quite discrepant from the objective evidence of actual risk (Gierlach, Belsher and Beutler 2010). Furthermore, Douglas and Wildavsky (1982) state that risk perception is the result of past experiences that shape individuals´ perspectives, providing cognitive schemes for defining and understanding risk.

Risk perception has also been defined as the judgments that people make when they are asked to characterize and evaluate hazardous activities and technologies (Slovic 1987). Therefore it is inherently subjective (Krimsky and Golding 1992), and it depends on awareness, cultures and social constructs (Slovic and Gregory 1999). Hence, risk perception is a subjective assessment of the probability of a specific type of accident happening, and to what extent individuals are concerned with the consequences (Sjöberg, Moen and Rundmo 2004:8).

Research regarding perceived risk began with the affect heuristic to understand a wide range of risk-taking behaviors (Kahneman, Slovic and Tversky 1982; Peters et al. 2006), including the use of simple gambles. This was followed by studies on the impact of Cultural

Theory (CT) and the Cultural Cognition theory (CC), where gender and race seem to be related to risk perception (Finucane et al. 2010; Finucane et al. 2010; Kahan et al. 2010; Satterfield, Mertz and Slovic 2010); past experience (Satterfield et al. 2010); and, finally, psychometric studies which assume that risk is defined by individuals in a subjective manner and determined by psychological, social, institutional and cultural factors (Slovic 2010:xxv).

The importance of risk perception is related to the influence that it has on government spending priorities, as citizens´ perception and awareness are translated into policies, much more than the actual risks identified by the experts (Slovic 1997). It seems that individuals reallocate responsibility for hazardous events according to the *forensic model* (Tansey and O'Riordan 1999), which means that, in industrial societies, the selection of risks is political.

This means that policymakers take action considering what ordinary citizens perceive as risks. When experts are asked to evaluate hazardous activities they contemplate technical aspects (Slovic, Fischoff and Lichtenstein 1982), while the lay public takes other aspects into account, for example, the threat to future generations. Therefore, we propose that risk perception may have an influence on individuals' support for society's commitment to reducing global climate change.

Cultural Theory

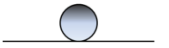
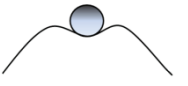
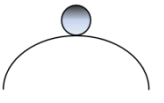
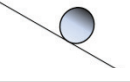
There are two trends concerning the definition of culture: first, some authors refer to mental constructs as values, beliefs and norms, or cultural bias; second, it refers to the social relations that determine individuals´ behavior and attitudes. Both ideas are integrated in Cultural Theory (CT) and defined as *ways of life* (Thompson, Ellis and Wildavsky 1990).

The anthropologist Mary Douglas (1978) established a model to explain people's behavior and beliefs, called the *grid-group cultural theory*. Later, her theory was further developed in other research (Douglas and Wildavsky 1982; Wildavsky 1987; Schwarz and Thompson 1990:6; Douglas 1992) and renamed the *Four Political Cultures* or *Cultural Theory (CT)*. This theory answers two central questions about the existence of human beings: '*Who am I*?' and '*How should I behave?*' (Wildavsky 1987).

This approach claims that our knowledge, our actions and our way of justifying what we do and our judgments of people's behavior are all biased. Schwarz and Thompson postulated the existence of these Political Cultures in terms of individuals' perception of risk. Each is a package of biases that explains the view of one's surroundings. Thus, the two dimensions of sociality (*group* and *grid*) generate four basic forms of social relationships (Schwarz and Thompson 1990:6): Fatalism, Hierarchy, Individualism and Egalitarianism.

Douglas (1998:98) took CT a step further by applying it to the view that individuals have about nature. This paradigm states that individual perceptions of different hazards depend on cultural values (Douglas and Wildavsky 1982). Thus, people from a particular dimension tend to assign similar reasons for events that are different from other dimen-

Table 1.
The Five Views of Nature (adapted from Schwarz and Thompson 1990: 5)

View of Nature	Description	Representation
Nature Benign	It gives us global or stable equilibrium. It does not matter what happens, the ball will always return to the bottom of the basin. The *laissez-faire* attitude is held by the managing institutions. There are abundant resources.	
Nature Capricious	Random world. They do not have any particular view concerning the environment. The situation of the resources is a lottery. Institutions with this view of nature do not really manage, nor do they learn. They just cope with erratic events.	
Nature Tolerant	The world is forgiving of most events, but is vulnerable to an occasional knocking of the ball over the rim. The resources are scarce, but they are controllable. The managing institutions must therefore regulate and control against unusual occurrences. It accepts that the small risk of disaster necessitates government regulation, but believes that, once minimum standards have been met, it should be free to make its own decisions. There are acceptable environmental risks that can be determined by experts.	
Nature Ephemeral	The world is a terribly unforgiving place and the least jolt may cause its catastrophic collapse. There is a precarious balance of the ball on the landscape. The managing institutions must treat the ecosystem with great care as the resources are depleting.	
Nature Gradual	Earth´s climate is slow to change. Global warming will gradually lead to dangerous effects. It is represented with a ball on an inclined landscape.	

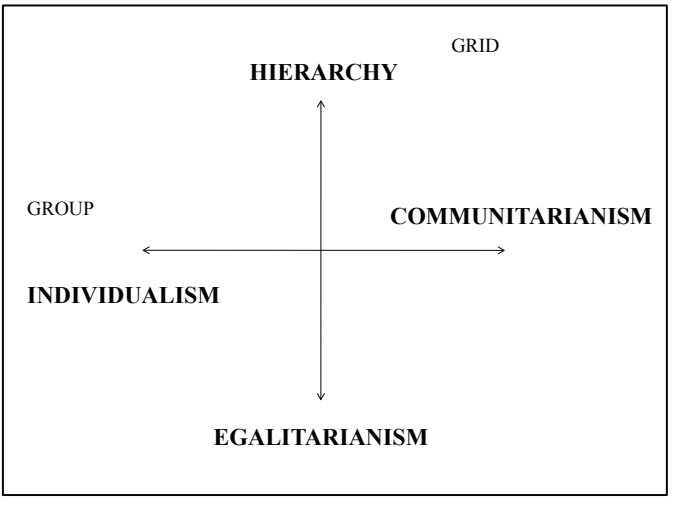
sions. Moreover, Schwarz and Thompson developed the four distinct views of nature which are in conflict with each other. Each view has a way of organizing and is predatory in terms of time, space and resources. These four 'views of nature' can be graphically represented by a ball in a landscape, as in Table 1 below. The fifth category is a new proposal added by Leiserowitz and Smith (2010).

Cultural Cognition

The CT of Risk (Figure 1) has been tested empirically by Kahan et al. (2010), who developed a new approach called Cultural Cognition (CC). This approach posits that individuals have different perceptions of risk, as mentioned above, and classify them in four types of worldviews or supportive values.

Initially, CC used Dake´s scales (1990; 1992) to measure worldviews, but instead of following the work of Jenkins-Smith and others with four scales (Jenkins-Smith 2001; Silva and Jenkins-Smith 2007; Jenkins-Smith and Herron 2009), Kahan et al. (2011) uses two continuous attitudinal scales given that the original scales failed to demonstrate internal validity when testing *Cronbach's alpha* and had a low degree of coherence and internal consistency. One of the scales is for "Hierarchy-Egalitarianism" and depends on the individual´s orientation for high or low *grid*. The other is used to measure the orientation toward weak or strong *group* ways of life, and distinguishes between "Individualism-Communitarianism" (see Figure 1). CC eliminates the *Fatalism* option, after which it has

Figure 1.
Cultural Cognition Worldviews (Kahan 2008)



been proven to have high reliability and avoid the logic indeterminacy problem associated with Dake´s scales (Kahan 2007).

The properties of the scale make it well suited for testing Douglas and Wildavsky's theory (Kahan 2008). Public risk perception should be correlated with a combination of cultural worldviews and the position of an individual in the "grid-group" map, as hypothesized by Douglas (1985:54). The present paper uses a "short form" version of the two scales, which consists of six "agree-disagree" items that are as reliable as the full-form counterparts (Kahan et al. 2011). Therefore, the scales are expected to measure two latent variables, one for each axis, resulting in the aggregation of the observable indicators determined by the twelve items.

According to the literature reviewed, we propose that risk perception might be influenced by cultural values (Douglas and Wildavsky 1982), but also by individuals' awareness (Slovic and Gregory 1999), which in this case is considered as involvement with the environment. Moreover, as mentioned before, risk perception is related to the influence that it has on government spending priorities (Slovic 1997) and thus might be linked to individuals' support for society's commitment to the environment.

Perceived consumer effectiveness and pro-environmental behavior

The concept of perceived consumer effectiveness was first described by Kinnear, Taylor and Ahmed (1974) as a measure of an individual's belief that he or she can make an effective contribution to abatting pollution. Likewise, Ellen, Wiener and Cobb-Walgreen (1991) state that this construct indicates the extent to which individuals have faith in their actions when trying to make a difference in solving a problem (i.e., global climate change). They defined it as individuals´ belief that their behavior will lead to the desired outcome.

Previously, some authors have also related this concept with pro-environmental behavior (Kinnear, Taylor and Ahmed 1974; Webster 1975) and tested it to predict socially responsible and green purchasing behavior (Kim and Choi 2005; Wesley, Lee and Kim 2012). Moreover, research has been conducted to broaden the investigation on whether perceived consumer effectiveness would have an important influence on environmental attitude or concern, and on pro-environmental behavior in general (Kim and Choi, 2003; 2005).

In the present research, we understand individuals' support for commitment toward the environment as a particular behavior that individuals may have with regard to how society, institutions and the government should perform concerning their impact on global climate change. Therefore, we propose that perceived consumer effectiveness may have an influence on this support for commitment to the environment.

Methods

In this study, several scales are used, based on a survey tool developed by the Yale Project on Climate Change Communication[1] designed to examine the US population's level of concern. Additionally, we have included items from the CC theory (Kahan 2008) and the view of nature (Douglas and Wildavsky 1982). Finally, we tested whether socio-demographic aspects determine both latent constructs: risk perception and support for climate change reduction efforts.

Two different analytical techniques were used in order to achieve the proposed objectives. First, separate models were developed and hierarchical multiple regression analyses were carried out. The initial model aimed at explaining and predicting the perceived risk of global climate change. Subsequent models tested the same independent variables as predictors of support for government, corporate, industrial, and citizen efforts to reduce global climate change.

Exploratory factor analysis with principal components extraction and varimax rotation was then conducted and a structural equation model was developed with the remaining factors to test and incorporate some of the preceding predictors such as involvement and hierarchism.

Procedure and respondents

The data for the present research were extracted from an online survey conducted in Spain. It was based on a survey related to individuals´ global climate change involvement, beliefs and policy preferences, among others, but it also included some questions related to cultural values based on CC by Kahan (2008).

The study was conducted with an online sample (n = 602, 52% females) recruited between June and July 2011. The ages of the participants ranged from 18 to over 75 years old (see Table 2), with an average of 42 years old.

Measures

The internal consistency of the questionnaire constructs was examined using Cronbach´s alpha test to assess reliability. Hinton et al. (2004) recommends four cut-off points, which involve excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below). Our results confirm that the

[1] http://environment.yale.edu/climate/http://environment.yale.edu/climate/ Part of this research was a result of the lead author's research trip to Yale University where he worked with Dr. Anthony Leiserowitz, director of the Yale Project on Climate Change Communication.

Table 2.
Socio-demographic Distribution

Sample		n = 835
Gender*		
Males		48
Females		52
Ages*		
18-24		13
25-34		22
35-44		20
45-54		24
55-64		17
65-74		4
75+		1
Education*		
Less than high school		3
High school		11
Some college		40
Bachelor's degree		46
Political ideology*		
Progressive-Left [1-5]	5	7
	4	13
	3	17
	2	8
	1	12
Conservative-Right [1-5]	1	11
	2	7
	3	11
	4	7
	5	6
DN/NA		1

* Data are given in percentages.

measurement of the variables is internally consistent since all the constructs verified high reliability. The constructs developed are the result of combining several items after analyzing them through exploratory factor analysis.

Risk Perception

This latent construct was measured by a combination of three single items based on individuals' perception regarding the level of environmental hazard. The items evaluated

whether participants perceived that global climate change would harm them personally, future generations and/or plant and animal species. The construct was pre-tested in a pilot survey conducted among 30 university students. Responses were rated on a four-point Likert scale ranging from "Not at all" to "A great deal" (α = 0.821).

Support for Commitment

To determine a value for this measure, individuals were asked about their support for commitments to reducing global climate change. Latent variables were divided into three categories according to the source of these commitments. The first source was government commitments (GOV_COM), which resulted from a combination of two items with a four-point Likert scale (α = 0.725); the second source was corporate and industrial commitments; and finally citizens´ commitments, the last two of which were measured by a single item (CORP&IND_COM: Do you think that *corporations and industry* should be doing more or less to address global warming?; CITIZENS_COM: Do you think that *citizens themselves* should be doing more or less to address global warming?).

Perceived Consumer Effectiveness

In the present paper, this latent variable was measured using a three-item scale (α = 0.792) with a 4-point Likert scale from "*Not at all*" to ""*A lot*", and was related to the effectiveness of the energy-saving actions taken by the participants.

Involvement

Environmental Involvement (INVOLV) was measured by a combination of two items through a 4-point Likert scale from "*Not at all*" to "*A lot*" presenting high reliability (α = 0.766): concern about global climate change which has previously been proven to be related to risk perception (Kahan et al. 2011); and previous thoughts regarding the issue.

Cultural Cognition Values

Cultural values scales derived from CC (egalitarianism vs. hierarchism and individualism vs. communitarianism) were used in the survey. In order to measure "hierarchism", a six-item scale was combined and tested to examine internal consistency: three of which would represent the positive part of the axis for hierarchical individuals, and the remaining would represent the negative part of the axis for egalitarians (leading to negative values for the mean in Table 3). Cronbach's Alpha gave a value of 0.722 for this index, indicating that the scale had high reliability. For "individualism", the combination of the six-item scale failed to reach a satisfactory Cronbach's Alpha value (0.552); therefore, all the items were tested independently to identify whether they would correlate with Risk

Table 3.
Internal consistency of the constructs

	Mean	SD	Cronbach's Alpha
RISK_PERC1	2.90	0.775	0.821
RISK_PERC2	3.62	0.623	-
RISK_PERC3	3.65	0.617	-
GOV_COM1	3.07	0.799	0.725
GOV_COM2	3.07	0.670	-
PERC_CE1	2.62	0.785	0.792
PERC_CE2	3.10	0.749	-
PERC_CE3	3.52	0.696	-
INVOLV1	3.15	0.694	0.766
INVOLV2	3.12	0.739	-
HREVDIS2	4.21	1.612	0.722
HWMNRTS	3.24	1.684	-
HTRADFAM	3.07	1.759	-
EWEALTH	-4.78	1.261	-
ERADEQ	-4.51	1.411	-
EDISCRIM	-4.27	1.387	-

Table 4.
View of Nature

People often disagree about how the climate system works. The five images below illustrate five different perspectives. Each image shows the climate system like a ball balancing on a line; however, it affects everyone differently to global warming. Which of the five images is closer to your opinion about how the climate system works? [Images were displayed randomly].	1. Stable (Nature Benign) 2. Random (Nature Capricious) 3. Fragile (Nature Tolerant) 4. Threshold (Nature Ephemeral) 5. Gradual (Nature Gradual)

Perception or Support for Commitments. Ultimately, only one of them was included in the models tested (IPRIVACY – The government should stop telling people how to live their lives) as a representation of the failed relationship that individualism had with the variables explained.

View of Nature

This variable was measured by a single item based on the theory developed by Schwarz and Thompson (1990) and adapted by Douglas (1998:98) as described before, and after adding a fifth option (Gradual) from Leiserowitz and Smith (2010). It was included in the subsequent analysis as an ordinal scale, where nature is viewed in five different ways, beginning from an option in which there are abundant resources and there is no environmental hazard (*nature benign*), up to an alternative where global warming will gradually lead to dangerous effects (*nature gradual*).

Exploratory factor analysis and structural equation modeling

Following the results obtained from the hierarchical multiple regression for risk perception and support for government commitments to reduce climate change and considering the correlations among the items of each independent variable, we decided to conduct an exploratory factor analysis with the latent constructs that seemed to be related. In this way, we were able to build an integrative model to show the relationship between perceived risk, perceived consumer effectiveness and support for government commitments to reduce global climate change. The results for both the analysis and the proposed model are presented later.

Results

The latent constructs described in the previous section were introduced as independent variables in the models proposed by hierarchical multiple regression in four steps (SPSS 18) to explain and predict the dependent variables in each of the sections. Risk perception toward global climate change is the first dependent variable, followed by support for government, corporate, industrial, and citizens' efforts. Structural equation modeling was then conducted with Lisrel 8.80 to test a more integrative model where risk perception and perceived consumer effectiveness are predictors of support for government commitments.

Models of global climate change risk perception

The first model included socio-demographic variables and found that only political ideology was a significant predictor of risk perception (p-value< 0.001) although it explained only 2.8% of the variance (F = 6.411, p-value < 0.001, R^2_{adj} = 0.028). This means that

individuals with a more progressive ideology would have a higher perception of the risk of global climate change.

Model 2 shows that involvement (β = 0.548, *p*-value < 0.001) also has a significant and positive effect on risk perception, explaining 30.4% of the variance (*F* = 62.476, *p*-value < 0.001, R^2_{adj} = 0.304). As a result, when people are more involved, they will perceive a higher risk of global climate change.

Model 3 includes the view of nature and found that this latent construct (β = 0.240, *p*-value < 0.001) together with involvement (β = 0.483, *p*-value < 0.001) are significant predictors of risk perception. The variance increased by 5.2% in the model proposed (*F* = 63.033, *p*-value < 0.001, R^2_{adj} = 0.356). These results verify that individuals who have a more catastrophic view of nature will have a stronger perception of risk.

Finally, the full model incorporated cultural values related to CC and raised the variance explained to 37.3% (*F* = 48.689, *p*-value < 0.001, R^2_{adj} = 0.373). The latent variable Hierarchical has a significant and negative relationship to risk perception (β = -0.166, *p*-value < 0.001), indicating that individuals who are more hierarchical will have a weaker perception of risk toward global climate change,

Table 5.
hierarchical multiple regression for global climate change risk perception

Independent variables	Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Female	0.067	0.060	0.028	0.019
Education	- 0.153	- 0.045	- 0.043	- 0.048
Political Ideology	- 0.075***	- 0.003	0.004	0.077*
INVOLV	-	0.548***	0.483***	0.446***
View of Nature	-	-	0.240***	0.228***
HIERARCHICAL	-	-	-	- 0.166***
IPRIVACY	-	-	-	0.017
F	6.411**	62.476***	63.033***	48.689***
Adjusted R^2	0.028	0.304	0.356	0.373
Dependent variable: RISK_PERC				

Entries are standardized regression coefficients
* significant at 0.05;
** significant at 0.01;
*** significant at 0.001.

while egalitarians will perceive a stronger hazard. Involvement (β = 0.446, *p*-value < 0.001) and view of nature (β = 0.228, *p*-value < 0.001) still show significant and positive relationships to risk perception. These results are consistent with the primary postulations: involvement and view of nature will determine risk perception, and partially support CC theory since hierarchism determines risk perception, but communitarianism does not.

Models of support for government commitment

The same variables were tested to examine whether they would predict support for government commitment to reduce global climate change. Model 1 shows that political ideology is a predictor of the dependent variable (β = -0.226, *p*-value < 0.001) and explains 4.6% of the variance (F = 10.252, *p*-value < 0.001, R^2_{adj} = 0.046). Once more, individuals with a more progressive ideology will support higher government commitment to reducing negative human impacts on the environment.

Model 2 found that perceived consumer effectiveness (β = 0.286, *p*-value < 0.001) and involvement (β = 0.451, *p*-value < 0.001) are significant predictors of support for

Table 6.
Hierarchical multiple regression for support for government commitment

Independent variables	Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Female	0.007	0.009	- 0.002	- 0.004
Education	- 0.018	0.016	0.017	0.015
Political Ideology	- 0.226***	- 0.088**	- 0.085*	- 0.021
PERC_CE	-	0.286***	0.276***	0.252***
INVOLV	-	0.451***	0.432***	0.411***
View of Nature	-	-	0.115***	0.105***
HIERARCHICAL	-	-	-	- 0.150***
IPRIVACY	-	-	-	- 0.059
F	10.252***	78.792***	68.951***	55.692***
Adjusted R^2	0.046	0.406	0.417	0.434

Dependent variable: GOV_COM
Entries are standardized regression coefficients
* significant at 0.05;
** significant at 0.01;
*** significant at 0.001.

government commitment. According to our hypothesis, both latent constructs determine the dependent variable. Moreover, political ideology shows a negative and significant relationship for support of government commitment (β = -0.088, *p*-value < 0.01). This model increases variance to 40.6% (*F* = 78.792, *p*-value < 0.001, R^2_{adj} = 0.406).

The inclusion of the item that measures the views of nature in Model 3 enhances the variance by 1.1% (*F* = 68.951, *p*-value < 0.001, R^2_{adj} = 0.417); view of nature (β = 0.115, *p*-value < 0.001), perceived effectiveness (β = 0.276, *p*-value < 0.001), involvement (β = 0.432, *p*-value < 0.001) and political ideology (β = -0.085, *p*-value < 0.05).

The last model explains 43.4% of the variance, with an increase of 1.7% compared to the previous model (*F* = 55.692, *p*-value < 0.001, R^2_{adj} = 0.434). The hierarchical latent construct shows a negative and significant relationship with the predicted variable (β = -0.150, *p*-value < 0.001), which is similar to the full model for risk perception. This means that egalitarians support stronger government commitment to reducing global climate change. However, the items related to communitarianism-individualism do not seem to have an effect on the predicted variable. In the last model, political ideology did not affect support for government commitment, although perceived consumer effectiveness (β = 0.252, *p*-value < 0.001), involvement (β = 0.411, *p*-value < 0.001) and view of nature (β = 0.105, *p*-value < 0.001) did. This full model verifies previous assumptions since perceived consumer effectiveness, involvement, view of nature and hierarchism seem to determine support for government commitment, but the relationship with the item that measured communitarianism is not validated.

Models of support for corporate and industrial commitment

When predicting the third dependent variable, the results show slight differences with the previous models. Here, socio-demographic variables appear to be predictors until the last step, while views of nature and cultural values do not seem to predict the variance. More specifically, the first model predicts 5.4% of the variance (*F* = 11.799, *p*-value < 0.001, R^2adj = 0.054) with both education (β = 0.086, *p*-value < 0.01) and political ideology (β = -0.217, *p*-value < 0.001) and presents significant relationships with the predicted variable. The values given suggest that individuals with a higher level of education and a more progressive ideology support greater corporate and industrial efforts to reduce global climate change.

Model 2 includes the effect of perceived consumer effectiveness (β = 0.215, *p*-value < 0.001) and involvement (β = 0.193, *p*-value < 0.001), education (β = 0.105, *p*-value < 0.01) and political ideology (β = -0.151, *p*-value < 0.01) with an increase of 10.6% (*F* = 22.693, *p*-value < 0.001, R^2_{adj} = 0.160) in the variance.

The third model incorporates the view of nature, although it does not have an influence on the dependent variable. Therefore, the variance does not increase (*F* = 19.068, *p*-value < 0.001, R^2_{adj} = 0.160), even though the estimated coefficients show minor changes.

The full model includes cultural values, but again the new variables do not affect support for effort in this particular case. The total variance is 16.4% (F = 15.008, p-value < 0.001, R^2_{adj} = 0.164), and four of the independent variables tested predicted support for corporate and industrial commitment: education (β = 0.105, p-value < 0.01), perceived efficacy (β = 0.211, p-value < 0.001) and involvement (β = 0.186, p-value < 0.001) have a significant positive effect on the dependent variable, while political ideology indicates a significant negative effect (β = -0.149, p-value < 0.001).

Table 7.
Hierarchical multiple regression for support for corporate and industrial commitment

Independent variables	Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Female	0.054	0.049	0.046	0.047
Education	0.086**	0.105**	0.105**	0.107**
Political Ideology	- 0.217***	- 0.151***	- 0.149***	- 0.128**
PERC_CE	-	0.215***	0.211***	0.202***
INVOLV	-	0.193***	0.186***	0.180***
View of Nature	-	-	0.039	0.032
HIERARCHICAL	-	-	-	- 0.055
IPRIVACY	-	-	-	- 0.073
F	11.799***	22.693***	19.068***	15.008***
Adjusted R^2	0.054	0.160	0.160	0.164

Dependent variable: CORP&IND_COM
Entries are standardized regression coefficients
* significant at 0.05;
** significant at 0.01;
*** significant at 0.001.

Models of support for citizens' commitment

Like in the previous section, education (β = 0.116, p-value < 0.01) and political ideology (β = -0.172, p-value < 0.001) are significant predictors of support for citizens' commitment to reducing climate change and explain 4.2% of the variance (F = 9.432, p-value < 0.001, R^2adj = 0.042).

Model 2 also shows a positive and significant relationship between the two new predictors – perceived consumer effectiveness (β = 0.355, p-value < 0.001) and involvement (β = 0.207, p-value < 0.001) – and the dependent variable, increasing the percentage of the variance to 25.6% (F = 40.258, p-value < 0.001, R^2_{adj} = 0.256).

Table 8.
Hierarchical multiple regression for support for citizens' commitment

Independent variables	Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Female	0.053	0.042	0.039	0.036
Education	0.116**	0.141***	0.141***	0.137***
Political Ideology	- 0.172***	- 0.090**	- 0.090**	- 0.025
PERC_CE		0.355***	0.353***	0.329***
INVOLV	-	0.207***	0.203***	0.181***
View of Nature	-		0.026	0.019
HIERARCHICAL	-	-	-	- 0.149***
IPRIVACY	-	-	-	- 0.026
	-	-		
F	9.432***	40.258***	33.599***	27.212***
Adjusted R^2	0.042	0.256	0.255	0.269

Dependent variable: CITIZENS_COM
Entries are standardized regression coefficients
* significant at 0.05;
** significant at 0.01;
*** significant at 0.001.

The incorporation of the view of nature in the third step does not improve the prediction and explanation of support for citizens' commitment to reducing climate change, but the variance decreases 0.1% (F = 35.599, p-value < 0.001, R^2_{adj} = 0.255).

Model 4 introduces the effect of the hierarchism index (β = -0.149, p-value < 0.001) and excludes the influence of political ideology from the prediction, explaining 26.9% of the variance (F = 27.212, p-value < 0.001, R^2_{adj} = 0.269). Level of education (β = 0.137, p-value < 0.001), perceived consumer effectiveness (β = 0.329, p-value < 0.001) and involvement (β = 0.181, p-value < 0.001) are still predictors of the dependent variable. These results are consistent with the premises regarding level of education, perceived consumer effectiveness, involvement and hierarchism predicting support for citizens' commitment, although view of nature and the CC theory do not seem to have an influence on the dependent variable.

Exploratory factor analysis

Further analysis was conducted in order to build a more integrative model that would explain the relationship between both risk perception of global climate change and perceived consumer effectiveness with support for government efforts to reduce it. In

Table 9.
Principal component analysis. Total variance explained

Component	Initial Eigenvalues		
	Total	% Variance	Cumulative %
1	4.013	40.128	40.128
2	1.451	14.509	54.638
3	1.196	11.964	66.602
4	0.999	9.995	76.596
5	0.690	6.899	83.495

Table 10.
Rotated component matrix

	1	2	3	4	5
RISK_PERC1	**0.909**	0.128	0.157	-0.082	0.129
RISK_PERC2	**0.889**	0.118	0.215	-0.076	0.160
PERC_CE1	0.086	**0.887**	0.133	-0.058	0.162
PERC_CE2	0.152	**0.881**	0.111	-0.131	0.115
INVOLV1	0.148	0.091	**0.908**	-0.086	0.118
INVOLV2	0.253	0.180	**0.762**	-0.063	0.314
EGALIT1	-0.104	-0.086	-0.045	**0.892**	-0.049
EGALIT2	-0.036	-0.088	-0.088	**0.890**	-0.093
GOV_COM1	0.123	0.139	0.165	-0.091	**0.910**
GOV_COM2	0.276	0.246	0.404	-0.101	**0.627**

the first step we found positive correlations between the items that shape the three latent constructs.

Principal component analysis does not require any particular hypothesis about the structure underlying the variables. This method seeks the best linear combination of the proposed variables which explains the highest percentage of data variance (Luque Martínez 2012:48).

The latent variables that were introduced in the exploratory factor analysis were chosen with two criteria: first, we focused on the latent variables that seemed to deter-

mine risk perception, perceived consumer effectiveness and support for government commitment; we then reduced them to the items that were measured in a continuous scale in order to facilitate the subsequent structural equation analysis. Consequently, we had five latent constructs that satisfied both conditions: perceived consumer effectiveness, involvement, hierarchism, risk perception and support for government commitment.

Exploratory factor analysis was conducted with SPSS 18 and we found that the items should be reduced to two for each construct. The results showed that principal component analysis was suitable for the remaining latent variables since: (1) Bartlett's test of sphericity provided significant differences between the correlation matrix and the identity matrix (Chi-Square = 2234.738; df = 45; p-value = 0.000); (2) Kaiser-Meyer-Olkin index was higher than 0.75; and (3) the correlation coefficients of the anti-image correlation matrix presented low values. Moreover, we found: (a) factor loadings higher than the required minimum ($R^2 > 0.5$); (b) high communalities for all the variables (> 0.5); and that (c) five factors were extracted as expected and according to the literature reviewed, thus explaining 83.5% of the data variance.

Structural equation modeling

Structural equation modeling (SEM) was used to test the postulations regarding the relationship of involvement and hierarchism in determining risk perception, perceived consumer effectiveness and support for government commitment, and the relationship between both perceived risk of global climate change and perceived consumer effectiveness with support for government commitment to reducing it. Hierarchical multiple regression supported some of our first assumptions by assessing the effect that each explanatory variable had on the dependent variable after considering the aggregate effect of the remaining variables. On the other hand, SEM allows testing the hypothesized effects between variables that were considered dependent in the first step, but are independent in the second step, as occurs with risk perception and perceived consumer effectiveness.

Thus, there are two exogenous variables: involvement and hierarchical (measuring egalitarianism vs. hierarchism); and three endogenous variables: two first-degree endogenous variables, which are risk perception and perceived consumer effectiveness; and one second-degree endogenous variable, which is support for government commitment (see Figure 2).

The first step in estimating the model was to prepare the data. Missing values were estimated using multiple imputation method by expectation-maximization. This method first imputes predicted scores for missing values for a number of regressions in which each incomplete variable is regressed on the remaining variables for a given case. The entire data set is then subjected to maximum likelihood estimation (Barrio García and Luque Martínez 2012:546). The test for univariate and multivariate normality suggested

Figure 2.
Proposed Structural Equation Model

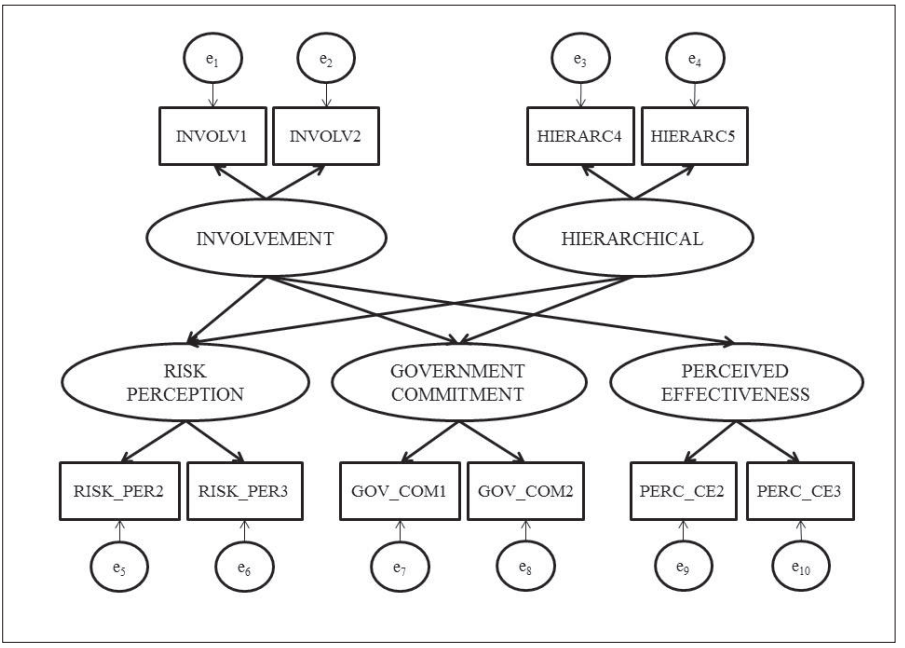


Table 12.
Global goodness of fit

	χ^2	p-value	RMSEA	AGFI	NFI	NNFI	IFI	RFI	CFI
Model	56.46	0.00075	0.047	0.95	0.98	0.99	0.99	0.97	0.99
Recommended		> 0.05	< 0.05	> 0.90	< 0.90	≈ 1	≈ 1	> 0.90	≈ 1

that the parameters should be estimated by Robust Maximum Likelihood in order to correct deviations. Global adjustment provided appropriate levels for the measures of goodness of fit as shown in Table 12.

The structural model adjustment was analyzed using the estimated coefficients significance, where almost all the values for the Student *t*-test were significant at a 95% level of confidence, except the relationships between risk perception and support for government commitment, which were significant at a 90% level of confidence. Moreover, when examining the reliability of the standardized coefficients (R^2) it was noted that

Table 13.
Structural model adjustment estimated coefficients

Observed Variables	Estimated Coefficients	t-student	R^2
PERC_CE2	0.62	-	0.71
PERC_CE3	0.58	13.38	0.69
INVOLV1	0.60	21.57	0.76
INVOLV2	0.52	15.68	0.49
HIERARC4	0.97	13.09	0.59
HIERARC5	1.16	13.25	0.68
RISK_PERC2	0.56	-	0.83
RISK_PERC3	0.54	20.15	0.77
GOV_COM1	0.67	-	0.71
GOV_COM2	0.46	14.36	0.47

Table 14.
Structural model adjustment: structural equations

Relationships	Estimated Coefficients	t-student	R^2
INVOLV → RISK_PERC	0.58	11.22	0.39
HIERARC → RISK_PERC	-0.11	-2.17	
INVOLV → PERC_CE	0.50	9.43	0.25
PERC_CE → GOV_COM	0.23	4.04	0.71
INVOLV → GOV_COM	0.61	7.61	
HIERARC → GOV_COM	-0.09	-1.93	
RISK_PERC → GOV_COM	0.09	1.62	

almost all of them were over 0.5. Likewise, the structural equations indicated that the relationships within the endogenous variable GOV_COM explain 71% of the variance for support for government commitment, 39% for the perceived risk of global climate change (RISK_PERC), and 25% for perceived consumer effectiveness (PERC_CE). The estimated standardized model is displayed in Figure 3.

Finally, to assess the measurement model adjustment, we computed the composite reliability for each of the latent constructs and the variance extracted. The values for composite reliability were all above the imposed limit (> 0.70).

Figure 3.
Estimated Structural Equation Model

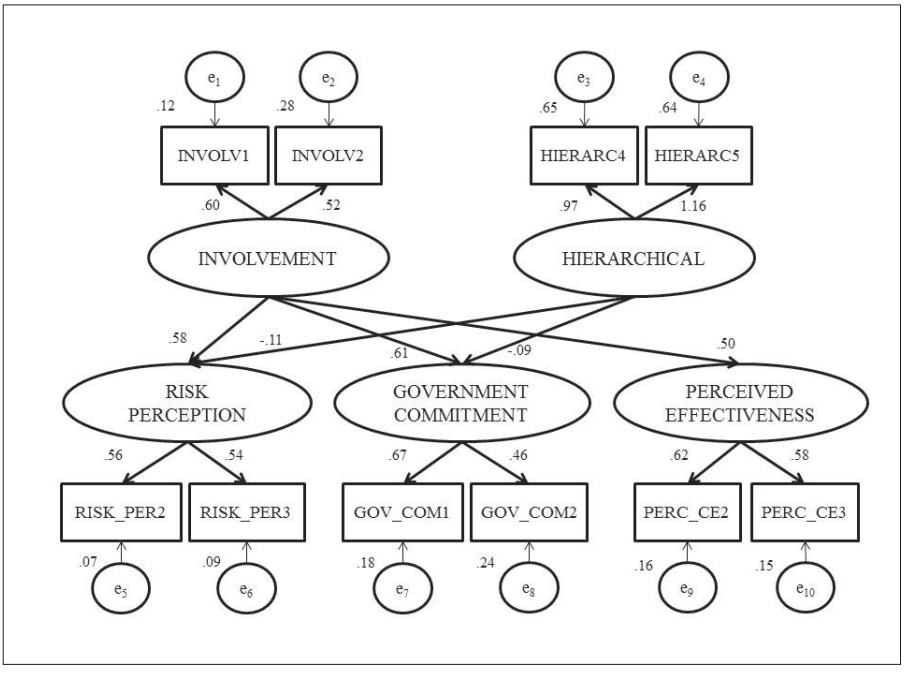


Table 15.
measurement model adjustment

Latent construct	Composite reliability	Variance extracted
PERC_CE	0.822	0.699
INVOLV	0.767	0.624
HIERARC	0.776	0.634
RISK_PERC	0.889	0.800
GOV_COM	0.738	0.587

The variance extracted indicates the percentage of the indicators explained by the latent variable. The scores obtained for variance extracted were over 0.50 and therefore adequately measured the latent construct (Barrio García and Luque Martínez 2012:564).

Conclusion

The present research aims at explaining and predicting three latent constructs: perceived consumer effectiveness, risk perception of global climate change and individuals' support for commitments to reducing it, as well as the relationship between them. We conducted hierarchical multiple regression analysis in four steps in order to test the proposed models and examine whether the underlying independent variables found in the literature would predict them. We also tested a SEM model to explain the intrinsic relationship between perceived consumer effectiveness and risk perceived with support for government commitment to reduce global climate change.

The analytical process was divided into six sections: the first one generated the results related to the hierarchical regression for risk perception, while the regression model for support for government commitment was developed in the subsequent section. In the third step, we analyzed support for corporate and industrial commitment and then explored support for citizens' commitment. Finally we developed an exploratory factor analysis followed by SEM to test the integrative model.

Some of the postulations tested were verified, indicating that risk perception of global climate change is predicted by involvement, view of nature and hierarchism. This suggests that the higher the involvement, the greater the perception of the risk of global climate change. Moreover, the more hazardous the view of nature that individuals have and the more egalitarian they are, the greater the risk perception. However, socio-demographic variables do not seem to influence the dependent variable in this particular full model.

Greater levels of perceived consumer effectiveness and involvement lead to increased support for government commitment. Views of nature and hierarchism, like the predication of risk perception, have positive effects on support for government commitment.

Likewise, there is more support for corporate and industrial commitment when the values for perceived consumer effectiveness and involvement are higher. On the other hand, the view of nature and cultural values do not have any effect in this case, but socio-demographic variables do: the higher the level of education and the more progressive the individuals are, the greater the support for corporate and industrial efforts to reduce global climate change. Moreover, citizens' efforts show higher values of support when the level of education, perceived consumer effectiveness and involvement are higher. In addition, individuals who are considered hierarchical are less likely to support commitments toward the cause.

The SEM results provide further support for the previous relationships, and also for the association between perceived risk and support to increase government com-

mitment. Overall, our results are consistent with CT regarding the influence of views of nature (Schwarz and Thompson 1990:5) on the variables tested. Individuals with a more drastic view of nature will perceive higher levels of environmental risk, and will also support greater government commitment to reducing global climate change. Furthermore, CC statements (Kahan et al. 2011) have also been proven but only with reference to egalitarian vs. hierarchical individuals. Therefore, cultural values will also affect both the perceived risk and the support for government commitment, which should be taken into account by policymakers in decision-making processes.

Previous research has explained the relationship between risk perception and policy preferences (Leiserowitz and Smith 2010; Kahan et al. 2011). Consequently, the results of the present research can be extrapolated to the relationship between risk perception and support for government commitment, which should have effects on policymakers' decisions when developing strategies related to reducing global climate change.

The importance of risk perception in today's societies indicates that cultural group membership should be considered in public and private risk communication campaigns related to the environment, which are based on perceived consumer effectiveness and involvement of the target audience.

Although these results show a consistent effect of some factors on the perception of risk regarding global climate change, as well as on support for the commitment of social agents (government, companies and individuals) to reduce it, there are some limitations: these results were obtained from a national sample using an on-line panel. This circumstance should be considered when making generalizations based on the main conclusions. Thus, the preceding methodology could be used in future research directed at conducting the survey in other countries in order to compare cross-national results.

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Nuria Rodríguez-Priego is Research fellow in the European Commission, Joint Research Centre (Information Society Unit). She works in projects related to behavioural studies which examine the role of information and communication technology (ICT) in transforming society and everyday life and developing evidence based policy support at European level. She was previously working as a Lecturer in Economics at the University of Granada.

Francisco J. Montoro Ríos is Lecturer in Marketing at the University of Granada. He is responsible for research projects related with consumption and the environment and member of the editorial board of the *Journal of Advertising Research*.

Nikolaos Georgantzís is Professor in Behavioural Economics at the University of Reading (Agriculture Policy and Development). He is the founder of two Experimental labs in Spain (LEE in Castellón and ΑΙΓΑΙΟ in Granada) and Associate Editor of the *Journal of Socio-Economics*.

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