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Personality traits and environmental choices: On the search for understanding

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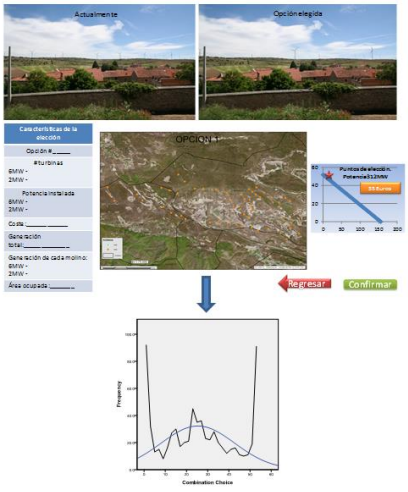
HIGHLIGHTS

- This paper focuses on the influence of personality on environmental choices.
- Applies an original methodology of experiments on continuous choice
- Explains environmental choices with the aid of the Five Traits Model

GRAPHICAL ABSTRACT



Abstract

In this paper we hypothesize that individuals will choose among alternative courses of action for power generation from wind farms according to their personality profiles. Through a factor analysis we found that certain characteristics of personality do indeed have an effect on environmental choice. The study involves an extensive survey based on the Big Five Traits model to find a pattern of choice that will help to better understand environmental decisions and be useful for policy makers to identify target groups and preview reactions to different courses of action. The research is potentially useful for the better preparation and design of publicity material, awareness raising campaigns and information provision for complex or unpopular policies affecting the environment or in environmental education in general. This research is especially interested in shedding some light on how personality is involved in the processes of environmental decision making, despite the limitations of the present study.

Keywords: big five traits and environment; continuous choice experiment; wind energy; personality and environment

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1. Introduction

Every decision we make is a manifestation of our preferences because we calibrate consequences allocating different weightings to the outcomes. Our choices express what we prefer and want. For marketed products it is easier to discover what is desired, because buying is a revealed expression of choice; while for non-market goods and services, such as the environment, it is necessary to apply valuation techniques to reveal gains and losses of different courses of action.

Environmental valuation is about providing estimates of the value of changes in non-market goods and services (Randall, 1974; Brookshire et al., 1976). These estimates of value are necessary to be included in welfare analysis or damage assessment. Valuation techniques are based on revealed preferences (what we do) and stated preferences (what we say we would do) or a combination of both. Applying valuation techniques involves making hypotheses about behaviour, handling data to fit a model and experimental actions which condition the underlying behavioural assumptions. The purpose of this is to yield good estimates for willingness to pay (WTP), as an expression of preference, giving us a figure for the value of the environmental good or service we are interested in. One of the most interesting behavioural phenomenon considered in valuation research is the variability of responses which we try to capture through statistical analysis. However, this statistical analysis is focused in attaining a single willingness to pay estimate aggregating responses so the variability or heterogeneity [1] of preferences and the important information that conveys will remain hidden.

Dealing with heterogeneity is key to get unbiased estimates since the average estimate represents only a fraction of the population. A large body of research on either reducing or explaining heterogeneity has taken two main approaches: by modeling statistically the heterogeneity itself and through the study of behavior.

During recent decades, modelling taste heterogeneity has been one of the challenges for economic valuation. The development and applications of the mixed or random parameters

model (Boyd and Mellman, 1980; Cardell and Dunbar, 1980; Train, 2003), latent class models (Lazarsfeld and Henry,1968; Goodman, 1974; Morey et al., 2006), hybrid choice models (Ben-Akiva et al., 1999 and 2002; Hess and Beharry-Borg, 2012) or mixed multilevel models (Farizo et al. 2014 a,b) have contributed to the best understanding of the individual preferences.

Also, there has been a substantial effort in trying to identify the scale of preferences (referred to the weight applied to all the attributes as a set) (Louviere and Meyer, 2007; Louviere et al. 2008; among many others) and the adoption of Bayesian approaches (Geweke and Keane, 2001). Recently, Fiebig et al. (2010) proposed accommodating both scale and residual taste heterogeneity within a single framework through the generalized multinomial logit model.

On the application of these approaches, the models include socio-economic covariates and descriptors of the situation of the individual at the time of the choice (whether stated or revealed), together with descriptive attributes or factors of the goods to be evaluated. Recently, authors with different approaches, such as Boxall and Adamowicz (2002), Johnston (2007), Soliño, et al. (2009), Scarpa and Thiene (2011), Farizo, et al. (2014a), Hoyos et al. (2015), have explored the latent nature of choices based on attitudinal aspects. Other aspects that are inherent in, and inseparable from the individual such as beliefs, past experiences, etc. (based on Fishbein and Azjen, 1975), are taking on a leading role and are increasingly and explicitly included in valuation work.

Inclusion of these variables reflects attempts to better understand the behavioural processes leading to environmental valuation, but they still rely on the broad principles of economic or econometric analysis. There has been no attempt to combine the economic or econometric analysis with other behavioural science disciplines to focus on the behavioural processes as the point of interest rather than the economic value that comes out of the process.

We therefore almost need to take a step backwards and rather than examining where the preferences explicitly form, examine how beliefs, perceptions and appreciation are related to behaviour. This will help us to get knowledge on how environmental values form from an integral perspective, looking at what motivates our responses from within our psychological profile and perhaps understanding better the application of existing theory.

Behaviour depends on personality and most of the studies on personality are about variations across individuals and how the differences shape individuals' lives and societal structures (Roberts et al., 2011). Among the facets of personality are what people think, feel and want or desire (Roberts and Wood, 2006), which have expected enduring patterns (Roberts, 2009) over the lifespan of individuals. There are only a small number of studies that consider personality

traits in valuations (López-Mosquera and Sánchez, 2013) or in environmental studies (Soliño and Farizo, 2014). As stated above, valuation techniques aim to produce some understanding on the behaviour of respondents when faced with a choice, but personality itself, the intrinsic characteristics of the individual which cause one to make a certain decision or prefer a certain outcome, is largely ignored.

The last decade has seen an increasing number of studies relating personality with issues such as the risk of developing certain illnesses, the tendency to adopt harmful habits, investors' profiles or if there is a defined national character (Schimitt et al., 2007). In environmental grounds, Markowitz et al (2012) have delved on the relationship between of personality characteristics and pro-environmental behaviour. This study examines whether the widely accepted big five traits or its sub-facets[2] can help explaining heterogeneity in responses related to environmental issues; to get some knowledge on how environmental choices are done, assuming that some personality characteristics may have different effects on behavior and this, on environmental choices. This prospection on the implications of such assumptions on theory is just on its beginnings.

For this purpose, the paper is structured as follows: the next section recounts in more detail the current methodological and possible combined approaches. This is followed by the use of a survey to test a suggested combined approach and the presentation of results. A discussion and conclusions are then provided to highlight findings and to make some suggestions on the application of the research in a policy context plus thoughts on future research implications.

2. Methodology

Stated preferences methods for valuing non-market goods and services share, to a large extent, the same foundations, namely Lancaster's theory of value (1966), rational consumer choice theory and random utility theory (McFadden, 1973). They are techniques that have been widely applied in marketing, psychology, transportation research and environmental economics (Green and Srinivasan, 1978, 1990; Louviere, 1988; Hensher, 1994; Gan and Luzar, 1993). The methods most used are contingent valuation (Carson, 2011) and discrete choice experiments (Louviere et al., 2000). In general, they all estimate functions of value, in which the dependent variable changes, in some cases, it is the acceptance of payment for an environmental good, the choice of an environmental option/good or service at a determined cost or the scoring or ranking of alternatives presented for examination. The explanatory variables traditionally pertain to two large groups; on the one hand, although not always, socioeconomic variables and descriptors of the individual situation at the time of the choice, and on the other, descriptive attributes or factors of the alternatives to be evaluated. Recently, authors with

different approaches, such as Boxall and Adamowicz (2002), Morey et al. (2006), Johnston (2007), Scarpa and Thiene (2011) or Hoyos et al. (2015), explore the latent nature of choices based on attitudinal aspects.

This is the line along which we have posed our working hypothesis. The variations in the preferences for the same type of environmental good can be due to three types of factors: (a) environmental, regarding the space being studied (geo-biophysical characteristics, environmental quality measures, similar spaces and substitutes, etc.); (b) socioeconomic (age, income, education level, etc.); and (c) individual aspects (likes, attitudes, beliefs, values). This latter factor is partly a function of the interactions of existing environmental condition of the institutions and cultural environment in which the individual is immersed and their personal background, all of which contribute to defining their personality. We believe that these three groups of factors interact with each other and make up a dynamic configuration of preferences.

Most literature has focused on studying how objective aspects of the individual, such as income, age or education, affect willingness to pay or, in brief, how individuals value environmental or other non market goods. However, aspects that are inherent in and inseparable from the individual such as attitudes, beliefs, etc. (based on Fishbein and Azjen, 1975), are taking on greater prominence and are increasingly and explicitly included in the literature. Those psychological aspects are more individually specific and give much more information than age or income about the individual and endure over the time and are good predictors of patterns of behaviour (McCrae and Costa, 2003), which is relevant in our research. It is probably true to say that factors such as income are really only just proxy outcome variables for the underlying ability of the individual. As an example of the influence of the environment, various authors such as Sagoff (1988 and 1998) propose visions of preferences from the citizen's point of view, in what are called community preferences.

This approach already has a history in literature, starting with Baumol, (1952) and followed by Harsanyi (1955), Musgrave (1959), Sen (1961), Marglin (1963), Tullock (1967), Goodin (1986). The same occurs with applications, such as with Gyrd-Hansen (2004), Álvarez-Farizo and Hanley (2006) and Álvarez-Farizo et al. (2007) where it is considered the roll adopted by the valuing individual. Other authors directly consider the heterogeneity of valuation as a consequence of the variability of the unobservable aspects of an individual (Louviere et al., 2000). For example Lee et al. (2008) relied on the Schwartz's theory of values to explain the differences between individuals in choice experiments studies. Other studies on the shaping of

preferences are those on the line pointed out by Norton et al. (1998) regarding institutional or by Seong-Hoon et al. (2007), Brereton et al. (2007) or Soliño et al. (2009), following the proposal by Fishbein and Azjen (1975), which basically refer to the fact that preferences are inspired by the social and regional environment in which individuals live.

In this paper we are to consider the relationship between personality and environmental choices individuals undertake in line with studies such as Hirsh and Dolderman (2007) or Hirsh (2010), who found that Agreeableness and Openness were significant predictors of pro-environmental values or Markowitz et al (2012) on the relation between certain facets and environmental behavior.

To explore the effects of personality on environmental attitudes and choices we applied the Revised Personality Inventory (NEO PI R©, Costa and McCrae, 1992) with 240 items. There are many other approaches to explore the personality facets (see Morey *et al.*, 2012 for a useful review) but our choice was based on that this is the most applied and explored method and on the fact that this is the most extensive personality test. With 240 items we could explore associations between facets or subfacets while other shorter text limit this possibility. The NEO PI R©, questionnaire based approach reveals the structure of participants' personality across five factors (FFM, John and Srivastavan, 1999). These five factors (or domains) are: Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A) and Conscientiousness (C). Each factor is composed of six facets (see Appendix for a description of each factor and facet). Neuroticism is related to well-being and mental health, where high scores on N indicate a tendency to be unhappy and prone to depression regardless the personal situation (Bagby et al., 1997). Conversely, high scores in extraversion reflect a tendency to be happy, popular and socially successful and high income (Soldz and Vaillant, 1999). Openness indicates flair and creativeness while low scores on this trait reflect fundamentalism (McCrae 1996). Agreeableness is a searched trait in relationships while the opposite shows a tendency to commit crimes and abuse of substances (Brooner et al., 2002). Conscientiousness is a good predictor for job and life performance and success (Weiss and Costa, 2005). On environmental grounds, Markowitz et al (2012) associated facets such as aesthetics, creativity and a variety of interests (Openness) and Extraversion to pro-environmental behaviors. In this study we are to identify which facets could show an environmental inclination in environmental valuation

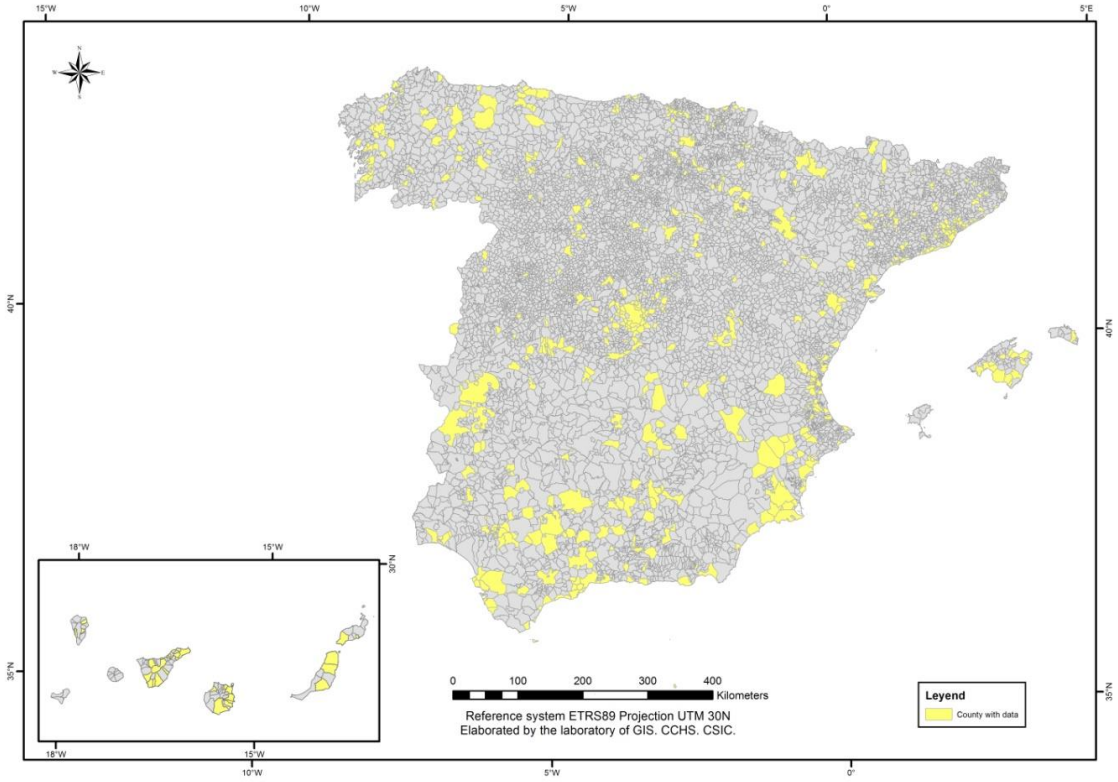
3. The data

In 2011, the AVEHETERO [3] project was launched with the intention of exploring the heterogeneity of preferences and how to address it. At the outset of this project it was

recognized that given the variety of different aspects to be analyzed, a large amount of information would be required from each respondent. Gathering such data from the same questionnaire could be complicated for respondents to understand and it could require several hours of interviewing. For that purpose a series of surveys were planned on the same panel of individuals and an identifier was used to guarantee anonymity and the ownership of responses. We departed from an original digital survey to a panel of 1000 respondents from all over Spain (see Figure 1 to see the spread of the sample over Spain) where they were questioned about preferences over repowering or increasing the number of wind turbines to raise the production of electricity from wind farms in Spain (but with a specific example about how this could be implemented in Maranchón, province of Guadalajara, which is one of the oldest and biggest wind farms in Spain and extended to the rest of the country). These individuals were then re-contacted for a second survey, where around 800 completed a personality test. After checking for cheaters and bad responses, 51 were eliminated. From the remaining 749, 48 additional individuals were eliminated since, to be in the overall database, responses to both questionnaires needed to be valid, thus 701 respondents are part of this research.

The data for this study therefore come from two questionnaires completed by the same 701 individuals. The first questionnaire[4], referred to from now on as the ENV-questionnaire, was about attitudes towards electricity generation in general and over wind farms in particular and other questions related with environmental issues. It also asked about their socio-demographic characteristics and they had to complete a (continuous) choice experiment (which will be shown in next section) on the preferences of increasing power generation. The second questionnaire, the PSY-questionnaire, is the NEO PI R© together with some questions about respondents' present circumstances and control questions to guarantee the match between participants in questionnaires ENV and PSY.

Figure 1. The sample



3.1. The ENV-questionnaire

Participants were told about the intention to increase power generation at different wind farms in Spain to accomplish the objectives of the Spanish agreement to increase the electricity from renewable sources of reaching the 35,000 installed MW on land and 3,000 MW on the sea by 2020. Maps on the actual situation of power generation in Spain from any source were shown. Our experiment explored the individual preferences over substituting 2MW older wind generators with new ones of 6MW (52 of 6MW) or to increase the number of 2MW generators from 102 to 156 (see Figure 2) in Maranchón (Guadalajara, Spain) or, alternatively, any combination of both types of wind turbines to reach 312 MW by 2020. Maranchón was presented as the pilot place for increasing wind farms capacity and the effects over the landscape, the habitats, the noise, etc., were shown through manipulated photographs and related information. Individuals then had to choose between combinations of 6 and 2 MW wind turbines. It is worth highlighting that neither option was identified as being more environmentally preferable. Some could consider for example, that upgrading from 2MW to 6MW wind turbines is preferable since the increasing size and noise of bigger turbines damage

harm birds and disturb local population, while the opposite argument could see the occupation of a wider territory as something to avoid.

Figure 2 shows how the combinations were shown to respondents. Clicking at each point on the choice line several windows open to show the relevant information together with maps and pictures (Figure 3). At the upper left ('*Actualmente*' in Figure 3) shows a picture of the landscape at the time and at the left, variation on the landscape with the option selected. Bottom left shows the characteristics of the choice, such as number of turbines of 6 and 2 MW, and power produced by each type of turbine and total, together with the cost of that combination[5]. In the center there is a map with orange dots representing where the wind turbines will be located with the exact number of turbines selected. At the right the chosen position and the new electricity bill are shown.

Figure 2. Points of choice: Combination of wind mills for 312 MW

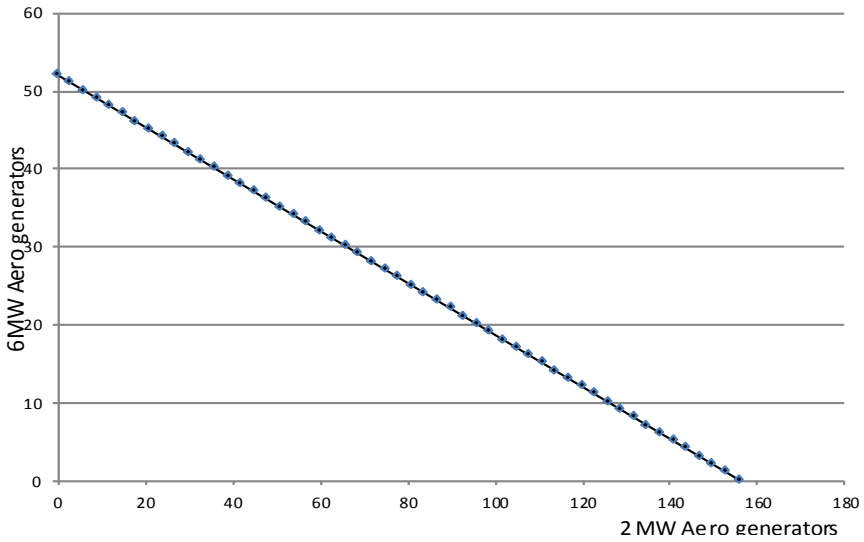
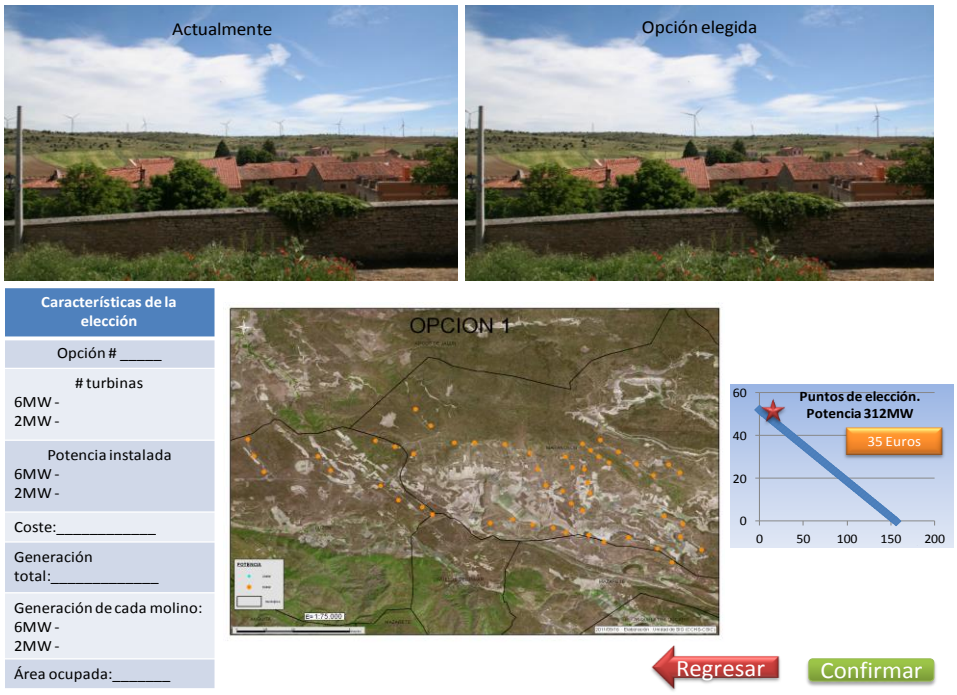
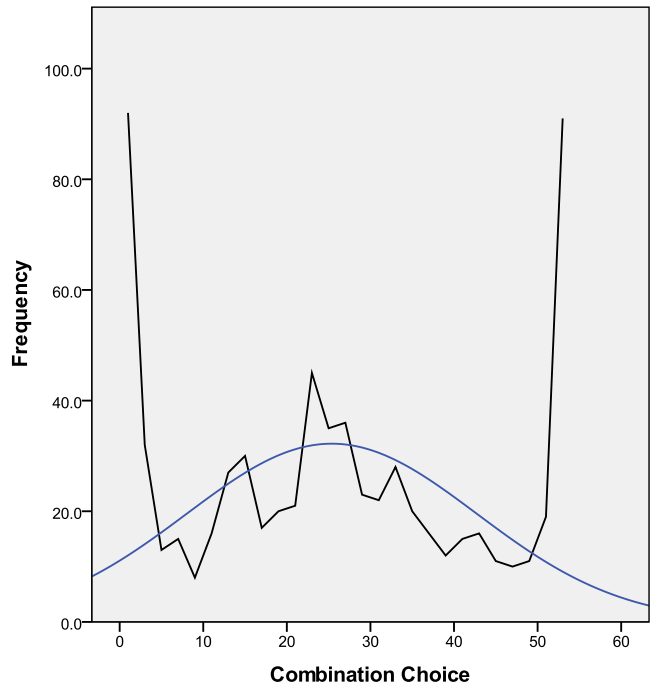


Figure 3. View of the screen after clicking on the first dot of the line



Each respondent could surf amongst the information but they were required to choose just once and to confirm if that was a definitive answer after being shown the effects of their decision. The distribution of responses regarding the turbine/power choice is shown in Figure 4. As can be seen, a large share of the answers were either point 1 (52 turbines of 6MW and 0 of 2 MW) with 12.3 % of the sample selecting this point or point 53 (156 turbines of 2MW and 0 of 6 MW) with an 11.8 % representation. This might be due to individuals not being sure what to do or those indifferent who do not care much about the experiment itself, choosing the easiest and fastest choice (either the 1st or the 53 rd). What is important to us though is to explore if there is a pattern on the behaviour of choice, finding out whether those individuals choosing other points, present a different profile than those choosing extreme points or if the overall sample can give accurate estimates of an aggregate societal choice.

Figure 4. Distribution of choices



From Figure 4, we can identify three broad choice strategies and groups. There are those discussed above who adopt the extreme positions of either choosing all 6MW turbines or all 2MW generators, with no combinations. We refer to these respondents, of which there are 175, as EXT (extreme). The second group is that comprising those who chose any position between the 23 rd and 30th option, which represents a mid-range compromise option. There were 147 individuals (21% of respondents), who chose in this range and we refer to them as MID. In the third group are those who took a minority choice strategy and are effectively those who were not either extreme or mid-range. We refer to these respondents as NOXNOM. Table 1 shows the composition and size of each sub-sample.

Table 1. Sample and sub-samples

Name of the group	Description	N
EXT	Individuals choosing either position 1st or 53rd	175
MID	Individuals choosing positions between 23rd and 30th	147

NOXNOM	Individuals choosing any position different than 1st or 53rd nor between 23rd and 30th	379
ALL	All the participants with valid responses	701

Having revealed different choice strategies in the ENV survey for the purposes of this paper, the key question then was therefore to see if there were any common personality traits that made individuals take these different choice positions.

3.2. The PSY-questionnaire

As stated above, the personality questionnaire was based on the NEO PI R© with 240 items. This made it a long questionnaire so we divided the questionnaire into twoparts, which were also sent to respondents a few days apart and they were asked to complete both parts without interruption. articipants were told the reason for the personality questions was entirely for scientific aim, being part of a study for the major research agency in Spain and they were offered the opportunity to see the results of the study. This was to help promote their honesty and sincerity in giving their answers. To control for cheaters, several cross-check questions were placed in the questionnaire to double-check erroneous answers and people just giving the same answer (for example selecting just the middle option) most of the time were eliminated from the final sample. Additionally, questions about their mood at the time of completion were asked as well.

The sample was composed equally between men (50.2%) and women and sample age ranged from 18 to 83 years old. Among the socio-demographic information they were required to state place of birth and where they lived until 18 years old, together with the number of years spent at each site. Tables B1 to B4 in Appendix B show the personality profile of the different samples. These come from a set of factor analyses where the best (based on BIC, Bayesian Information Criteria) and lowest classification errors consist on combination of the 5 factors.

We applied here a Latent Class DFactor model[6] which differs from the traditional factor-analytic model in that the latent variables (Factors) are assumed to be dichotomous or ordinal as opposed to continuous and normally distributed. There is also a strong connection between DFactor models and IRT[7] or latent trait models. Actually, DFactor models are discretized variants of well-

known latent trait models for dichotomous and polytomous items (Heinen, 1996; Vermunt, 2001; Vermunt and Magidson, 2005).

As in maximum likelihood factor analysis, modeling under the LC DFactor approach proceeds by increasing the number of discrete factors until a good fitting model is achieved.

Our factor model has the following probability structure (for 2 factors and 3 indicators)

$$P(y_{i1} = m_1, y_{i2} = m_2, y_{i3} = m_3) = \sum_{x=1}^{K} P(x_1, x_2) \prod_{t=1}^{3} P\langle y_{it} = m_t | x_1, x_2 \rangle$$

The conditional response probabilities $P\langle y_{it} = m_t | x_1, x_2 \rangle$ are restricted by means of logit models with linear terms

$$\eta^t_{m_t|x_1,x_2} = \beta^t_{m0} + \beta^t_{m10} \cdot x^{1*}_{x1} + \beta^t_{m20} \cdot x^{2*}_{x2}$$

As can be seen, two-variable terms are restricted using the category scores x^{l*}_{xl} and higher-order interaction terms are excluded from the model. As a results of these two types of constraints, the parameters describing the strength of relationships between the factors and the indicators – here, β^t_{m10} and β^t_{m20}– can be interpreted as factor loadings.

Table B1 in Appendix B is for the whole group (ALL), where factor 1 (HN) has the highest values for the facets related to *neuroticism*. Likewise factor 2 (HOHA) has the highest scores for *agreeableness* and *openness to experience* and some facets of *extraversion* (*warmth* and *gregariousness*). Factor 3 (HO) shows the most extreme values for *conscientiousness* and low in *neuroticism* and factor 4 (HEHO) holds the most extreme values on *extraversion* and *openness* to experience.

For the EXT sample (Table B2 in Appendix B), Factor 1 has the highest scores on *Conscientiousness* (HCLN), Factor 2 is mainly about high in *Neuroticism* (HN), Factor 3 has high scores on *Openness to Experience* (HO) and Factor 4 is a combination of low *Neuroticism* and *Agreeableness* (LALCLE)

For the NOXNOM sample (Table B3 in Appendix B), Factor 1 reflects the highest scores for *Neuroticism* traits (HN), Factor 2 for high *Conscientiousness* and low in *Neuroticism* (HCLN), Factor 3 is for *Extroversion* and some traits of *Openness* (HEHO) and Factor 4 for Openness and Agreeableness (HOHA).

Table B4 in Appendix B shows the factors of the MID group. Five factors captured the heterogeneity of this group. HCLN is high in conscientiousness and low in neuroticism, LCHN the opposite, low in conscientiousness and high in neuroticism, etc.

In general, comparing the scores at first glance they do not seem to have significant differences among them but when factor analysis is applied, groups with similar patterns on traits appear more clearly. Personality profiles for non-extreme are more concentrated than for extreme responses participants'.

4. Results and discussion

With this personality data and the wind farm survey, we analyze the potential relationships that shed some light on the way people make choices in relation to an environmental good. For this purpose, we regressed the personality profiles over the choices individuals made for increasing electricity production from non-polluting wind farms, that is, we regressed the personality profiles together with the characteristics of their choices and other personal covariates over their final choice on the combination and number of turbines . We apply a latent class regression (in Latent Gold® 5.1) to identify segments with similar personality profiles influencing choices and the rest of the information to explain segments. The predictors of the choices are based on the personality profiles shown above. The big five traits are represented by N (neuroticism), E (extroversion), O (openness to experience), A (agreeableness), and C (conscientiousness) and before each trait there is an H (high) or an L (low). For example the predictor HCLN for NOXNOM sample means high in conscientiousness and low in neuroticism or LALCLE means low in agreeableness, low in conscientiousness and low in extroversion. For each subsample, the personality factors are different, showing that the characteristics that describe each group are not coincident. Table 2 shows all the predictors included in the estimations.

Table 2. Predictors on models

Predictor	Description	In model
HN	High Neuroticism	NOXNOM, EXT, ALL

HCLN	High Conscientiousness, Low Neuroticism	NOXNOM, MID, EXT
HEHO	High Extroversion, High Openness	NOXNOM, ALL
HOHA	High Openness, High Agreeableness	NOXNOM, ALL
HO	High Openness	EXT, ALL
LALCLE	Low Agreeableness, Low Conscientiousness, Low Extroversion	EXT
LCHN	Low Conscientiousness, High Neuroticism	MID
HA	High Agreeableness	MID
LCHNLA	Low Conscientiousness, High Neuroticism, Low Agreeableness	MID
LELO	Low Extroversion, Low Openness	MID

Apart from the personality traits themselves, other assumptions were made about the influence of the background and past of participants. Questions such as where they were born and lived until they were 18 years of age together with questions about how they grew up, their lifestyle, place and way of spending their holidays etc., provide us with indirect information about their tastes and what is familiar to them. Table 3 shows some statistics and complementary information relating to this.

Table 3. Other covariates explored

	Percentage
Num. of sites of residence till 18	
1	54.5
2	26.3

3	9.9
Summers at:	
Home	36.2
Family house at the countryside	34.2
Different hotel or apartment each summer	15.1
Same hotel or apartment each summer	10.9
Camping	3.3
Other	9.5
Siblings	
1	36.4
2	28.5
3	13.4
Income in €	
< 1000	17.1
between 1001 - 1500	21.8
between 1501 - 3000	25.9
between 3001 - 4500	6.3
between 4501 - 6000	1.1
I prefer not to answer	20.8
Age	
< 30	20.8
between 31 and 45	30.3

between 46 and 60	28.2
between 61 and 70	11.3
up to 83	2.9

Table 4. Random Parameters for preferences for increasing electricity generation by wind farms

EXP_FINAL	NOXNOM		MID	EXT		ALL	
Size	*54%*		*21%*	*25%*		*100%*	
	Coeff.	RP	Coeff.	Coeff.	RP	Coeff.	RP
Intercept	2.68 (23.02)	0.64 (26.29)	3.20 (53.30)	1.88 (15.29)	1.52 (20.26)	2.99 (67.21)	
HN	0.10 (1.94)	-0.24 (-3.72)		0.02 (0.38)	-0.01 (-0.18)	0.17 (4.55)	0.88 (24.47)
HCLN	-0.11 (-2.21)	-0.44 (-7.63)	0.004 (0.11)	-1.68 (-11.82)	-0.93 (-10.17)		
HEHO	-0.11 (-2.16)	0.47 (7.87)				0.21 (7.33)	-0.27 (-11.01)
HOHA	-0.05 (-0.95)	0.36 (5.28)				-0.33 (-10.09)	0.59 (26.07)
HO				-0.67 (-8.51)	1.44 (15.00)	-0.45 (-11.91)	0.65 (25.81)
LALCLE				-0.73 (-8.25)	1.53 (14.74)		
LCHN			0.028 (0.75)				
HA			0.005 (0.13)				
LCHNLA			-0.003 (-0.09)				

LELO		-0.004 (-0.11)			
Income	0.01 (2.74)	-0.004 (-1.13)	-0.13 (-16.81)		
Age	0.01 (3.96)	0.000 (0.73)	0.002 (2.07)	0.003 (3.76)	
NO EXT				0.02 (1.40)	
MID				-0.18 (-8.61)	
EXT				0.15 (9.97)	
Mod for Class					
Intercept	0.64 (6.66)	-0.25 (-2.08)	-0.40 (-3.44)		
NSITE	-0.04 (-0.76)	-0.07 (-1.13)	0.10 (1.97)	0.02 (2.15)	
Man	-0.02 (-0.40)	-0.11 (-1.79)	0.13 (2.20)		
R^2	*0.90*	*0.06*	*0.98*		
R^2 Overall	*0.98*				*0.78*

t-ratio in parenthesis

Table 4 refers to the turbine choices made by the sub-samples: NOXNOM, MID and EXT and by ALL. The choice of combinations of wind turbines are explained in part by personality factors referred above. Based on Bayesian Information Criterion, our best model is composed of 3 latent classes. For the EXT group there are 3 traits combination-factors significant and quite a high randomness in their responses. For MID group, as said, we could not find any explanatory variable for their behaviour and the R-squared is too low. One explanation for this is that this group is so heterogeneous and that there are many individuals who prefer the "comfort" middle zone on questionnaires for not compromising; making groups with people with non- well-formed preferences on the issue of study.

High neuroticism (HN) is only significant for NOXNOM (who chose any point except the extremes and middle positions); not even in combination with other traits. Hirsh (2010) explains this relationship since neurotic individuals tend to worry about negative consequences in general and points, precisely to *anxiety* about the consequences or outcomes as an important explanation. Our results show *anxiety* as the highest facet on the HO (*high openness*) for NOXNOM. High *extroversion*, *conscientiousness*, *agreeableness* and *openness to experience* explains individuals tendency to choose less wind turbines but with higher power, while in the case of the EXT there is a mixing in the behaviour. *High conscientiousness* has been related with environmental concern (Hirsh, 2010) and with pro-environmental behaviours (Markowitz et al 2012) and is expected to adequately follow the rules for a better and environmental friendly behaviour.

In line with previous results by Hirsh (2010) and Hirsh and Dolderman (2007), we observed that facets of traits such as agreeableness and openness are related to a greater environmental concern (preference for turbines of greater power since the occupied surface is lower), specifically *altruism* (concern for the welfare of others) and *trust* (belief in the good intention of others) on the side of the agreeableness and *aesthetics* (appreciation of beauty), *feelings* (to inner emotions) and *values* (readiness to re-examine the values) for the side of openness. Comparing these results with a regression with random parameters for the ALL group we do not find the same results about what influences turbine choices and how, indicating that identifying people in behavioural segments can increase the ability to explain choice. Conversely, the MID and EXT groups show significance while the NOXNOM group not. This result may be suggesting that, in the aggregation process, the mixing of opposite stances may produce bias estimates.

It is worthwhile to highlight that the LALCLE factor (Low Agreeableness, Low Conscientiousness, Low Extroversion) tend to choose extreme positions (EXT), again in line with the outcome above.

The covariates included in the regression explain the composition of the classes but they do not inform on the choices made. This is interesting since it avoids the dilemma of selecting between a better regression and a model suitable for posterior benefit transfer or other alternative uses. In our case, for example, high income and older people are more prone to choose any point in the choice spectrum (NOXNOM) than extreme points or the comfort area.

5. Conclusions

Our results show that there is a relationship between the choices individuals make and their personal characteristics, measured this time, apart from the typical covariates such as income, age, etc., by their personality traits highlighted by the big five (traits) model (*neuroticism, agreeableness, extroversion, openness to experience* and *conscientiousness*). The big five traits themselves are too general and wide to explain this kind of behaviour referred to environmental public choices, for this, we opted for factor analysis providing us combinations of traits. Using factor analysis allowed us to work with a big amount of data (240 items) too which would not have been possible otherwise. These 240 items were summarized in approximately 30 facets instead of the big five traits.

Some personality facets endure over the time but are, in part, shaped by the environment where we grow and develop. Knowing the facets that are prone to favour environmentally friendly attitudes and behaviours might help us to prepare and design better awareness raising campaigns specifically focused in getting the acceptation of less popular policies affecting the environment. It might also help to educate and involve those individuals who do not yet have well developed environmental preferences for programs of actions, such as the indifferent MID group in this paper, since interventions could focus on making the programs more appealing to their personality characteristics.

Disentangling how personality shape our choices will help us gain better knowledge about the meaning of values we derive through environmental valuation techniques. Examples such as the findings on *Anxiety*, as pointed above, reflecting concern for the possible outcomes of the proposal, could suggest a more realistic and convincing exposition of the consequences to produce more robust estimates. The same kind of analysis can be made for the most relevant facets of the personality.

The application of models identifying segments is key since not only is the interpretation and application of results and groups straightforward, it manages the heterogeneity on preferences on a deterministic focus, converting a problem rich in information for policy management. In

addition, the latent class model applied in here, utilizes the covariates to describe the composition of the class, rather than in the determination of choice segments.

This is the first of a series of experiments carried out on the same panel of individuals, where they have been given the opportunity of choosing and playing different roles at different experiments. Apart from the size of the sample (701), one of the strengths of this paper was using the 240-item NEO PI R© allowed us to base the study on lower order facets. This aspect highlighted that some facets are more related than others to environmental attitudes. Despite the advantages of this study, the applicability of our findings is not straightforward with this particular experiment. That is, the benefits and damage of the proposal, namely, re-powering the wind farms by substituting present 2MW turbines with 6MW or, alternatively, increase the number of 2MW with new turbines, or combinations of both are not clearly better in one or another sense.

Is it environmentally preferable to use a bigger share of the land or to use less but at a probable higher collision of birds and more visible and noisy turbines? The answer is not definite and clear at first glance but some personality characteristics will favour some actions over others and some of those characteristics have been proven to correspond to certain social attitudes. However, the paper has shown that untangling the personality traits which lie behind variations in valuation is possible and will help to provide a better framework for the design of environmental policies and the acceptance of environmental change by diverse social groups.

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Appendix A. Big Five Traits or Five Traits Model

Neuroticism: A tendency to experience emotions such as anxiety, anger, or depression. It is also sometimes called Emotional Stability. It is related to one's emotional stability and degree of negative emotions. People that score high on neuroticism often experience emotional instability and negative emotions. Traits include being moody and tense.

Traits	Description
Anxiety	Level of free floating anxiety
Angry Hostility	Tendency to experience anger and related states such as frustration and bitterness
Depression	Tendency to experience feelings of guilt, sadness, despondency and loneliness
Self Consciousness	Shyness or social anxiety
Impulsiveness	Tendency to act on cravings and urges rather than reining them in and delaying gratification
Vulnerability	General susceptibility to stress

Extroversion: quantity and intensity of energy directed outwards into the social world. It is about interacting with others. Extraversion includes the traits of energetic, talkative, and assertive and the tendency to seek stimulation and the company of others.

Traits	Description
Warmth	Interest in and friendliness towards others
Gregariousness	Preference for the company of others
Assertiveness	Social ascendancy and forcefulness of expression
Activity	Pace of living
Excitement seeking	Need for environmental stimulation
Positive Emotion	Tendency to experience positive emotions

Openness to Experience: People who like to learn new things and enjoy new experiences usually score high in openness. Openness includes traits like being insightful and imaginative and

having a wide variety of interests, like the appreciation for art, emotion, adventure, and unusual ideas; imaginative and curious.

Traits	Description
Fantasy	Receptivity to the inner world of imagination
Aesthetics	Appreciation of art and beauty
Feelings	Openness to inner feelings and emotions
Actions	Openness to new experiences on a practical level
Ideas	Intellectual curiosity
Values	Readiness to re-examine own values and those of authority figures

Agreeableness: the kinds of interactions an individual prefers from compassion to tough mindedness; individuals with a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. These individuals are friendly, cooperative, and compassionate. People with low agreeableness may be more distant. Traits include being kind, affectionate, and sympathetic.

Traits	Description
Trust	Belief in the sincerity and good intentions of others
Straightforwardness	Frankness in expression
Altruism	Active concern for the welfare of others
Compliance	Response to interpersonal conflict
Modesty	Tendency to play down own achievements and be humble
Tender mindedness	Attitude of sympathy for others

Conscientiousness: degree of organisation, persistence, self-control and motivation in goal-directed behaviour act dutifully, and aim for achievement People that have a high degree of conscientiousness are reliable and prompt. Traits include being organized, methodic, and thorough.

Traits	Description

Competence	Belief in own self efficacy
Order	Personal organisation
Dutifulness	Emphasis placed on importance of fulfilling moral obligations
Achievement striving	Need for personal achievement and sense of direction
Self Discipline	Capacity to begin tasks and follow through to completion despite boredom or distractions
Deliberation	Tendency to think things through before acting or speaking.

Appendix B. DFactor results

Table B1. Factors for ALL

	HN	HOHA	HO	HEHO	R^2
Anxiety	0.6972	-0.0722	-0.1762	-0.0726	0,5276
Angry Hostility	0.4556	-0.4201	-0.3548	-0.0000	0,5099
Depression	0.7001	-0.2362	-0.3015	-0.2379	0,6934
Self Consciousness	0.6077	-0.2630	-0.2051	-0.3360	0,5934
Impulsiveness	0.3152	-0.0571	-0.4339	0.1060	0,3021
Vulnerability	0.5703	-0.1901	-0.3572	-0.4048	0,6528
Warmth	-0.1751	0.6271	0.1615	0.2785	0,5275
Gregariousness	-0.1152	0.3770	-0.0000	0.2440	0,2150
Assertiveness	-0.3908	0.1477	0.0721	0.6139	0,5566
Activity	-0.0943	0.1790	0.0846	0.5258	0,3246
Excitement Seeking	0.0642	-0.0636	-0.2113	0.2493	0,1150
Positive Emotion	-0.2153	0.4472	0.0696	0.4273	0,4338
Fantasy	0.0825	0.1992	-0.2823	0.1819	0,1592
Aesthetics	-0.0000	0.3810	-0.0000	0.1916	0,1819
Feelings	0.0000	0.4065	0.0000	0.4389	0,3579
Actions	-0.1548	0.1943	-0.1609	0.2218	0,1368
Ideas	0.0000	0.2193	0.0000	0.3034	0,1401
Values	-0.0000	0.2033	-0.0731	0.0644	0,0508
Trust	-0.2853	0.5104	0.1937	0.0595	0,3830
Straightforwardness	-0.0000	0.3294	0.2710	-0.2021	0,2228
Altruism	-0.0000	0.6211	0.2624	0.1486	0,4766
Compliance	-0.1011	0.3398	0.3309	-0.3139	0,3337
Modesty	0.2506	0.2430	-0.0000	-0.3915	0,2751
Tender Mindedness	0.1038	0.5344	0.1257	0.0000	0,3122
Competence	-0.2539	0.1807	0.5475	0.3889	0,5481
Order	-0.0680	-0.0000	0.4409	0.2873	0,2815
Dutifulness	-0.0471	0.3575	0.6062	0.2322	0,5514
Achievement Striving	-0.0960	0.1209	0.3853	0.5202	0,4429
Self Discipline	-0.2841	0.2067	0.5312	0.3775	0,5482
Deliberation	-0.1788	0.0768	0.6118	0.0000	0,4122
Social Desirability	-0.0723	0.4631	0.5740	0.2664	0,6200

Table B2. Factors for EXT

	HCLN	HN	HO	LALCLE	R^2
Anxiety	-0.1165	0.6659	0.1575	0.2023	0.5228
Angry Hostility	-0.1480	0.3356		0.5569	0.4447
Depression	-0.2525	0.7088	-0.0251	0.4055	0.7312
Self Consciousness	-0.2706	0.5708	-0.1443	0.4692	0.6401
Impulsiveness	-0.1616	0.2450	0.3740	0.2565	0.2918
Vulnerability	-0.4146	0.5235	-0.0467	0.3662	0.5822
Warmth	0.0000	-0.0418	0.5568	-0.6060	0.6790
Gregariousness		-0.0376	0.3616	-0.4049	0.2961
Assertiveness	0.3894	-0.3530		-0.1519	0.2994
Activity	0.2631	-0.1097	0.4298	-0.2685	0.3381
Positive Emotion	0.1063	-0.1760	0.4839	-0.4929	0.5193
Fantasy	-0.2966		0.4349	-0.0281	0.2779
Aesthetics		-0.0221	0.5679	-0.2877	0.4057
Feelings		0.0559	0.6008	-0.3856	0.5127
Ideas		-0.0718	0.4429	-0.0915	0.2097
Trust		-0.2658	0.3486	-0.5583	0.5039
Straightforwardness		-0.0802		-0.3648	0.1395
Altruism	0.1971	0.0050	0.4300	-0.6032	0.5876
Compliance		-0.1346	-0.0000	-0.4620	0.2316
Tender Mindedness		0.0708	0.4470	-0.3673	0.3398
Competence	0.5805	-0.1466		-0.2756	0.4344
Order	0.6198		-0.2009	-0.0573	0.4278
Dutifulness	0.5888	0.0504		-0.3546	0.4750
Achievement Striving	0.5750	0.0257		-0.2525	0.3950
Self Discipline	0.6447	-0.1131	-0.1264	-0.3979	0.6028
Deliberation	0.4731	-0.1317	-0.2810	-0.2942	0.4068
Social Desirability	0.6013	-0.0049	0.0769	-0.5170	0.6348

Table B3. Factors for NOXNOM

	HN	HCLN	HEHO	HOHA	R^2
Anxiety	0.7221	-0.2092	-0.0990	-0.0894	0.5830
Angry Hostility	0.5388	-0.3937	-0.0323	-0.3948	0.6023
Depression	0.7050	-0.3367	-0.2512	-0.1614	0.6995
Self Consciousness	0.6363	-0.2606	-0.3541	-0.1713	0.6275
Impulsiveness	0.2859	-0.4428	0.1356	-0.0364	0.2975
Vulnerability	0.6062	-0.3490	-0.3917	-0.1414	0.6628
Warmth	-0.2953	0.2248	0.3962	0.5555	0.6033
Gregariousness	-0.1715	0.0166	0.3882	0.3218	0.2840
Assertiveness	-0.4002	0.0978	0.6058	0.0809	0.5433
Activity	-0.1445	0.0871	0.6111	0.0439	0.4039
Excitement Seeking	0.0292	-0.1555	0.3191	-0.0356	0.1282
Positive Emotion	-0.2928	0.0776	0.4909	0.4217	0.5106
Fantasy	-0.0482	-0.2270	0.1552	0.2068	0.1207
Aesthetics	0.0227	0.0089	0.1546	0.3145	0.1234
Feelings	-0.0121	0.0431	0.4120	0.3600	0.3014
Actions	-0.1915	-0.1255	0.2543	0.2044	0.1588
Ideas	-0.0924	0.1049	0.2242	0.2520	0.1333
Values	-0.0325	-0.1177	-0.0025	0.3369	0.1284
Trust	-0.3640	0.2381	0.1373	0.4960	0.4541
Straightforwardness	-0.0324	0.2851	-0.1816	0.3318	0.2253
Altruism	-0.0604	0.3081	0.2143	0.5692	0.4685
Compliance	-0.0731	0.3197	-0.3505	0.3430	0.3481
Modesty	0.2509	0.0077	-0.4051	0.3120	0.3245
Tender Minderness	0.0271	0.1996	0.0879	0.5270	0.3260

Competence	-0.2664	0.5923	0.3653	0.1201	0.5696
Order	-0.0178	0.3266	0.2254	-0.1028	0.1683
Dutifulness	-0.0923	0.6378	0.2638	0.3235	0.5895
Achievement Striving	-0.0960	0.3863	0.5150	0.0288	0.4245
Self Discipline	-0.3148	0.5182	0.3864	0.1032	0.5276
Deliberation	-0.0664	0.6219	-0.1217	0.0346	0.4072
Social Desirability	-0.1168	0.6055	0.2655	0.4189	0.6263

Table B4. Factors for MID

	HCLN	LCHN	HA	LCHNLA	LELO	R^2
Anxiety	-0.3342	0.4160	0.2937	0.3028	0.2465	0.5235
Angry Hostility	-0.0263	0.3921	-0.3448	0.4312	0.1799	0.4916
Depression	-0.3780	0.4595	0.0429	0.4674	0.3737	0.7140
Self Consciousness	-0.2326	0.2974	0.0472	0.3548	0.5119	0.5326
Impulsiveness	-0.1844	0.5976	-0.2420	0.1530	-0.2431	0.5322
Vulnerability	-0.5874	0.2625	0.0269	0.4065	0.3536	0.7049
Warmth	-0.0864	-0.0243	0.2856	-0.5722	-0.4507	0.6202
Gregariousness	-0.0283	-0.1127	0.1287	-0.3255	-0.3684	0.2718
Assertiveness	0.4537	0.0444	-0.2889	-0.3112	-0.4278	0.5711
Activity	0.2393	0.1316	-0.0822	-0.2225	-0.3463	0.2507
Excitement Seeking	-0.0358	0.2142	-0.2860	0.0833	-0.1546	0.1598
Positive Emotion	0.1961	0.1485	-0.1400	-0.3874	-0.5692	0.5542
Fantasy	-0.0023	0.4792	-0.1248	-0.1066	-0.3706	0.3939
Aesthetics	0.0924	0.2130	0.1404	-0.2734	-0.3304	0.2576
Feelings	0.3296	0.3373	-0.0735	-0.3946	-0.4380	0.5753

Actions	0.0817	-0.0059	-0.0423	-0.0000	-0.4208	0.1855
Ideas	0.3628	0.2341	-0.0316	-0.1701	-0.2503	0.2790
Values	0.1022	0.1592	0.0535	-0.0522	-0.3556	0.1678
Trust	-0.2027	-0.2607	0.4421	-0.4280	-0.2659	0.5584
Straightforwardness	-0.2102	-0.1812	0.4626	-0.3510	0.1480	0.4361
Altruism	-0.1934	-0.0169	0.5641	-0.4507	-0.3058	0.6526
Compliance	-0.1322	-0.3690	0.5712	-0.3071	0.0204	0.5747
Modesty	-0.3714	-0.0476	0.4926	-0.0133	0.2174	0.4302
Tender Mindedness	-0.1042	-0.0171	0.4579	-0.3109	-0.1376	0.3363
Competence	0.6700	-0.1771	0.0170	-0.3975	-0.0685	0.6433
Order	0.4782	-0.1661	0.0241	-0.2989	0.1935	0.3836
Dutifulness	0.2708	-0.1346	0.5137	-0.4647	0.0534	0.5740
Achievement Striving	0.5824	0.1574	-0.1280	-0.3499	-0.2152	0.5490
Self Discipline	0.5724	-0.1152	0.1503	-0.4107	-0.0399	0.5337
Deliberation	0.4508	-0.5341	0.2767	-0.2100	0.3211	0.7123
Social Desirability	0.3162	-0.0198	0.5495	-0.5516	-0.0497	0.7090

[1] Variability in responses might come from within subjects, between subjects, between contexts, between measurement instruments, etc. (Louviere, 2001).

[2] Five Factor Model (FFM) was first proposed by Tupes and Christal (1961, 1992) and today is the default model of personality structure and it is a straightforward way to describe relations among traits (Costa and McCrae, 2008), since empirical research showed that the traits assessed were related to the lexical Big Five Factors (McCrae, 1989).

[3] AVETEHERO project (*2010/2014 - ADVANCES IN ENVIRONMENTAL VALUATION: INFLUENCE OF THE HETEROGENEITY*) was funded by *Spanish Ministry of Science and Innovation.* This project was focused on exploring the causes and effects of heterogeneity of preferences in environmental valuation and means of dealing with it.

[4] Questionnaire in Spanish available under request to the authors.

[5] On this figure, this information is blank.

[6] Latent Gold® 5.1 was the software used on the analysis

[7] Item Response Theory