THE STRUCTURE OF BRITISH ATTITUDES TOWARDS CLIMATE CHANGE: A RE-EVALUATION OF THE VBN MODEL

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Abstract

Understanding the structure and composition of environmental concern is crucial to the study of society's engagement with environmental problems. Past research has typically served to test, apply or extend value-belief-norm (VBN) theory – a theoretical model which proposes that attitudes are derived from the values placed on the self, others or nature. The VBN has been so influential that one might say that it has become almost paradigmatic in the way that it has shaped research designs. Here, we focus on testing the VBN rather than developing it, using a combination of exploratory and confirmatory factor analysis applied to a representative UK dataset designed without a priori commitment to a theoretical model. A three-factor model was confirmed to be the most substantively and methodologically optimal. The most noteworthy component is a factor consisting of high loadings from both pro and anti-environmental statements, suggesting a paradoxical form of environmental concern. Nonetheless, the overall three-factor model does broadly align with the VBN model, allowing for complex environmental attitudes to be derived from the pre-defined value orientation. We conclude by affirming the VBN paradigm, with some reservations.

1 INTRODUCTION

As a psychological phenomenon, Environmental Concern (EC) has been continuously investigated for four decades. Its study has provided a greater understanding of how individuals relate to their environment as well as the comprehension (and possibly actuation) of pro-environmental behaviour. When research on EC began in earnest in the 1970s, the emphasis was on how EC could spread from small groups of environmental activists, to being experienced more widely.[1] After the political intensity of that decade began to fade, research on environmentalism turned inward, focusing on the examination and conceptualisation of EC, driven by the need to understand attitudinal and behavioural engagement with environmental issues. In terms of practical application, understanding public engagement with 'the environment' may lead to more targeted and nuanced environmental messaging, encouraging greater concern and increasing the frequency of pro-environmental behaviour. Yet achieving such benefits requires an understanding of what environmental concern is – and therein lies the focus of this paper.

In the literature, EC is taken to broadly refer to the degree to which people are aware of problems regarding the environment, their support of efforts to solve such problems and a willingness to contribute personally to their solution (Dunlap, & Jones 2002, p. 485). This definition rightly indicates that EC is a very broad concept covering a wide range of phenomena with multiple aspects and dimensions (see also Xiao, & Dunlap 2007; Alibeli, & White 2011). Both (Dunlap, & Jones 2002) and Klineberg *et al.* (1998) emphasise that the broad definition of EC implicitly requires researchers to: "think clearly at the outset about what aspects or facets of environmental concern they want to measure, and then carefully conceptualize them prior to attempting to measure them" (Dunlap, & Jones 2002, p. 515) thus avoiding further ambiguity in concept definition and variations or errors in variable measurement.

EC is largely considered to be attitudinal in nature. Minton and Rose (1997) conceptualise EC as constructed from a broad range of environmental attitudes. Similarly, Vining (1992) treats EC and environmental attitudes as synonymous, defining EC as the development of an array of attitudes toward the environment. However, the exact structure of these attitudes has yet to be confirmed and the composition of EC remains uncertain. Furthermore, on-going EC research is required due to the continuously changing nature of both environmental problems and the relationship of the human population to them. As the effects of climate change are experienced and perceived in different ways by different people in different countries and mediated by a host of differing factors, attitudes are likely to change in unpredictable ways. To reiterate Stern *et al.* (1995) "Although it is safe to expect many newly described environmental conditions to take form as social attitude objects, it is not easy to predict what form they will take, what attitude will form about them, or whether public opinion will be of one mind or be fragmented" Stern *et al.* (1995, p. 1612). Without greater

[1] *Such research was conducted by Buttel and Flinn (1974; 1978), Dunlap (1976) and Dunlap and Gale (1972) amongst others.*

clarification structure and composition of EC, a clear understanding of attitudinal and behavioural engagement with current environmental issues is unlikely to emerge.

1.1 THE VBN VALUE FRAME

Since the late nineties, a second wave to the study of EC has, by asking fundamentally different questions, opened new promising lines of inquiry. Rather than investigating general attitudes about environmental issues, this research seeks identify underlying *values* that provide the basis for environmental attitudes (e.g.Wesley Schultz, & Zelezny 1999), thus moving towards a more differentiated conceptualisation of environmental attitude formation.

Values are usually theorised as being relatively stable over the life course and allow individuals to subjectively judge what is important (Slimak, & Dietz 2006). By contrast, Stern et al. (2000) maintain that attitudes are mutable; they can appear, disappear and change over time. Understanding the link between values and attitudes is important. One approach is to view relatively enduring value orientations interacting with more fluid contextual (and lifecourse) factors to produce attitudes. A key theory that embodies this approach is the value-belief-norm theory described by Stern et al. (1995; 1999; Stern 2000).

The VBN links three theoretical models: norm-activation theory, the theory of personal values, and the new ecological paradigm, into a unified explanation for environmentalism. While the VBN theory is intended to explain behaviour, embedded within it is a theory of environmental concern. The theory postulates that values, are at the core of environmental concern (Slimak, & Dietz 2006) and that an individual's value orientation is focused on the self, other people or nature, and from these value orientations, corresponding attitudes of EC are formed. More specifically - from this perspective - the EC attitude object is formed of the three components outlined in Table 1.

Table 1: VBN Value Orientations and Corresponding Attitudes of Environmental Concern

Value	Environmental Concern
Nature	*Biospheric*
The self	*Egoistic*
Others	*Social-Altruistic*

Of these components, egoistic concerns are based on a person's valuing himself or herself above other people and other living things. As Stern, & Dietz (1994) observe "Egoistic values predispose people to protect aspects of the environment that affect them personally, or to oppose protection of the environment if the personal costs are perceived as high". Social-altruistic values lead to concern for environmental issues when a person judges environmental issues on the basis of costs to or benefits for other people. Biospheric EC is based on a value for all living things, regardless of any social benefits the natural environment may yield.

Much empirical research has been conducted utilising the VBN model as a theoretical framework to clarify EC composition. Results have, though, been inconsistent. For example, empirical support is mixed for a separate biospheric value orientation. A distinct biospheric attitude of EC suggests that nature is perceived to have an intrinsic value, worth protecting for its own sake (see Attfield 1981; Merchant 1992; Naess 1984). Steg *et al.* (2005) has reported direct evidence for a distinct biospheric value orientation. Social-altruism has also been distinguished from biospheric attitudes in numerous studies (Stern et al 1993; Gagnon Thompson, & Barton 1994).

However, in some factor analytic studies, social altruistic and biospheric value items have been found to load on the same factor (Schwartz 1992; Stern et al 1995; Stern et al 1999) An amalgamation of biospheric concern with social-altruism might suggest a desire to preserve the natural environment because of the benefits this may potentially yield to society or possibly as Stern et al (1995) suggest the biospheric value orientation may be part of a more altruistic orientation.

In another permutation, Schultz (2000; 2001) found a distinct biospheric concern, with egoistic and social-altruistic concerns combining into a single factor. This result is in line with Thompson and Barton's (1994) proposition that environmental attitudes may be considered as having either an anthropocentric or ecocentric value focus.

These varied findings challenge the VBN model, in that they do not conform to the notion of three separate and distinct value orientations. Instead attitudes of EC seem to be derived from two possible dichotomised values sets as shown below in Figure 1.

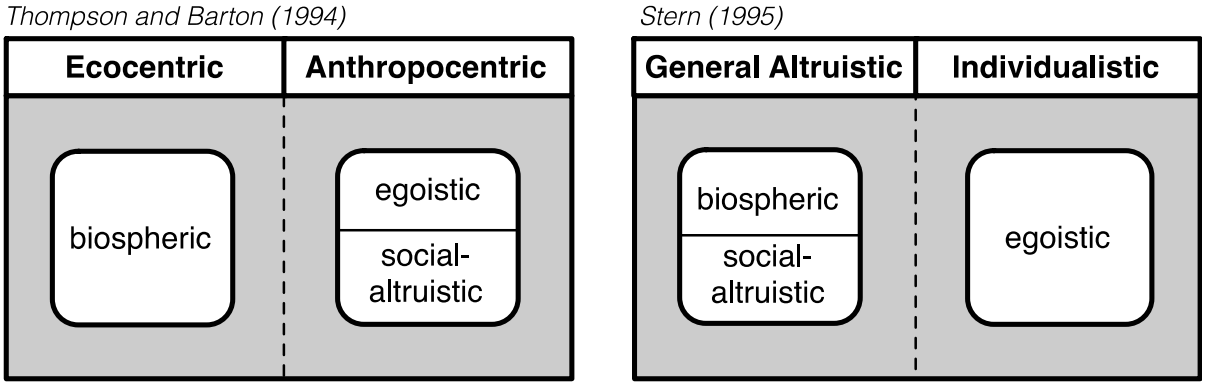

Figure 1: Dichotomous Value Orientations

Both of these dichotomous value orientations allude to how individuals appreciate nature (i.e. for its intrinsic value or its potential benefits) and whether EC attitudes are based on an individual's distinction between the individual self and the outside world, or between society and nature.

These contrasting findings and reflections raise the question of the veridical value/attitude structure for EC. In response to such inconsistencies, both Schultz (2000; 2001) and Snelgar (2006) have tested several different factor structures for EC. As shown in Table 2, Schultz (2000; 2001) tested one, two and three-factor measurement models for EC. The three-factor model (highlighted below) was found to be both theoretically and statistically optimal: adhering to the VBN model and satisfying both the K1 and scree plot tests.

Table 2: Environmental Concern Models Tested by Schultz (2000, 2001)

Model 1	***One-factor model:*** *Uni-dimensional EC*
Model 2	***Two-factor model:*** *Biospheric items loading onto one factor with both egoistic and altruistic items loading on another factor. This is consistent with Thompson and Barton's (1994) classification of environmental attitudes.*
Model 3	***Three-factor model:*** *Egoistic, altruistic, and biospheric concerns fitted the data well, providing support for the notion that three value-orientations underlie EC.*

Snelgar's (2006) later study tested a total of five models, including both dichotomous value orientations, and found that a two-factor model with a distinct biospheric component had the best fit to the data. Overall however, the best model was a four-factor structure, in which the biospheric attitude split into two separate biospheric concerns for plant and animal life.

Table 3: Environmental Concern Models suggested by Snelgar (2006)

Model 1	***One-factor model:*** *Uni-dimensional EC.*
Model 2	***Two-factor model:*** *Egoistic items load onto one factor, both altruistic and biospheric items load onto a second. This is based on Stern et al.'s (1995) suggested that biospheric value may be part of a general-altruistic cluster.*
Model 3	***Two-factor model:*** *Egoistic and altruistic items load onto one factor, biospheric load onto a second. This provided a better fit of the data than Model 2, supporting Thompson and Barton's (1994) dichotomous value orientation.*
Model 4	***Three-factor model:*** *Separate biospheric, egoistic and social-altruistic components, as suggested by the VBN model.*
Model 5	***Four-factor model:*** *Distinct egoistic and social-altruistic components, as well as two separate biospheric components for plant and animal life. This model provides the best fit to the data.*

Overall therefore, studies suggest that the biosphere is perceived to have an intrinsic value. However Snelgar's (2006) study suggests that there is a distinction between concern for the welfare of species and the preservation of the countryside, opening up the possibility of a fourth value orientation, or possibly that VBN value orientations form the basis for multiplicious attitudes.

1.2 QUESTION SCALES IN THE VBN

Studies that aim to examine EC from the VBN perspective naturally use question scales designed to reflect components of the VBN. Hence the Environmental Concern (EC) and Adverse Consequences (AC) scales were used to generate data for both the Snelgar and Schultz studies. The EC scale constructed by Schultz (2000) employs the statement: I am concerned about environmental problems because of consequences for '_____'. Respondents are then asked to rate nouns such as: me, my health, people in the community, future generations, plants, trees, whales, etc. The AC scale has been described as a measure of general beliefs about environmental consequences (Stern et al 1995). A set of items on a Likert scale measures awareness of consequences relating to each of the egoistic, social and biospheric value orientations.

EC studies that have implemented these scales have reported exploratory and confirmatory analyses verifying Stern's VBN structure (Hansla et al 2008; Milfont, & Gouveia 2006). This,

though, is in one sense unsurprising, given that these scales only measure components of the VBN structure. Granted the studies could have found no evidence in support of the VBN framework, but if other possibilities were not sought, it is debateable whether they would be found (a view consistent with Duhem's view (1906, p. 1954) that theories give meaning to 'facts' (Oberheim, & Hoyningen-Huene 2009): work conducted in a deductive mode may or may not be open to finding other patterns in the data, depending on the researcher's objective). Such scales also oblige respondents to answer according to the structure of the questions, thus increasing the likelihood of them confirming the VBN structure in their responses. Here is an argument to be made for the unsuitability of using the same scales at different points in time: if the VBN model assumes that attitudes are in a state of flux, while values are comparatively more stable, then attitude scales too are likely to be subject to at least some degree of change.

A further critique of scale implementation is the burden placed on researchers to gather a suitable sample, ideally a representative one. Given the high demand on time and resources required to gather primary data, such a sample is often not obtained. For example, conclusions drawn Schultz (2000) and (2001) cannot be generalised to their respective populations given their use of small and unrepresentative samples: both studies consisted of psychology undergraduate students from the United States (sample of 400 and 1010 respectively). Snelgar (2006) obtained a convenience sample of 368 participants. Of these participants, 296 were undergraduate students taking psychology modules at the University of Westminster. The remaining 72 participants were recruited with the use of snowball sampling. Snelgar acknowledges that due to these sampling methods, conclusions about larger populations cannot be drawn. Results that cannot be generalised to the wider population are diminished in value: it is uncertain whether the findings exist in the social world or if they are simply characteristics of the sample acquired.

Secondary data analysis of representative survey data provides at least a partial solution to all of these problems. Accordingly, this paper adopts a different approach to investigating EC, and aims to determine whether VBN components can emerge without the use of these scales, placing the research emphasis on determining whether the model exists in the social world at all (and in what form). Data generated without an a priori commitment to a specific theoretical framework places fewer limitations on participant responses, potentially reducing bias and allowing for results that are outwith the model. This line of research thus has the potential to not only independently test the VBN but also to reveal if there are alternative EC attitudes that derive from the value orientations. To determine whether this model exists in the social world, the sample used in the analysis must be representative allowing conclusions can be generalised to the wider population.

2 DATA

Here, analysis is performed on results from DEFRA's[2] 'Survey of Public Attitudes and Behaviours towards the Environment' (hereafter EAS[3]). The 2009 wave of EAS is used, with

[2] *Department for Environment, Food and Rural Affairs (Defra)*

a representative sample size of 2929 participants. Data was gathered using quota sampling via face to face interviews and a two stage stratified sample design. It is acknowledged by DEFRA that there are some issues with the use of quota sampling regarding the representativeness of the sample this method yields. However, interviews were carried out using census output areas as sampling units. Census output areas are small, homogeneous areas, comprising about 125 - 150 households. This approach minimises interviewer bias, which can be introduced by interviewers personally selecting the areas they work in. Output areas were also stratified by socio-economic variables within region, to ensure a representative sample of all areas. Furthermore, quotas were applied to all interviewer assignments to control for likelihood of selected respondents being at home. These quotas were set on sex, working status and presence of children in the household. Using demographic quotas avoids over-representation of those groups who are more likely to be at home when interviewers call. Interviewers worked between 2pm and 8pm on weekdays and at weekends to further minimise the response bias which is introduced by only working during standard working hours.

The EAS dataset is explicitly divided into three sections: Household and Respondent Characteristics, Environmental Behaviours, and Environmental Attitudes. The latter portion of the EAS dataset is used for this analysis. From this section, the variables that in some way express belief or affect in respect of the environment were selected. [4]These variables were derived from responses to the statements shown in

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[3] *Environmental Attitudes Survey (EAS)*

[4] *Some attitude variables were excluded from the present analysis on the basis that they may primarily capture financial concern, opinions on government policy or taxation, or self-efficacy rather than directly to environmental concern. Undoubtedly such variables do have a relationship with environmental concern but they almost certainly prior rather than constitutive.*

Table 4, with which participants indicated levels of agreement on a 5-point Likert scale.

Table 4: Indicator Variables for Subsequent Latent Variable Analysis

Variable Name	Statement
Major Disaster	*If things continue on their current course, we will soon experience a major environmental disaster.*
Limited Resources	*The Earth has very limited room and resources.*
Crisis Exaggerated	*The so-called 'environmental crisis' facing humanity has been greatly exaggerated.*
Too Far in Future	*The effects of climate change are too far in the future to really worry me.*
Over Populated	*We are close to the limit of the number of people the earth can support.*
Changes to Countryside	*I do worry about the changes to the countryside in the UK and the loss of native animal and plants.*
Loss of Animal Species	*I do worry about the loss of animal species and plants in the world.*
Beyond Control	*Climate change is beyond control – it's too late to do anything about it.*
Low Priority	*The environment is a low priority compared to other things in my life.*

Of these indicator variables, there are those that correspond to the components of the VBN model. That is, the *Changes to Countryside* and *Loss of Animal* species variables correspond to the biospheric component. The *Over Populated* and *Limited Resources* variables correspond to the social altruistic component, and finally, *Too Far In The Future* and *Low Priority* could be interpreted as egoistic. The remaining three variables (major disaster, crisis exaggerated and beyond control) are free to load onto any VBN components (if they do emerge) potentially enrich their interpretation and in turn the understanding of EC. Alternatively they could into load onto a separate component or not load at all.

3 METHODS

A combination of Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) methods are used. The software package employed was MPLUS. Deciding upon the optimal number of factors to be retained from EFA is crucial. It is important to distinguish between major and minor factors; specifying too few or too many can distort results. There is no clear consensus for factor retention criteria. The most commonly used method is known as the K1 rule, which retains factors with eigenvalues greater than 1 (see Kaiser 1960). Another, less sophisticated method for retaining factors is through the examination of Cattells (1966) scree plot for breaks and discontinuities, only retaining factors above a significant inflection. This method suffers from subjectivity and ambiguity, particularly if there is no clear inflection. A third method is Parallel Analysis (PA), which uses random data with the same number of observations and variables as the original data (see Fabrigar et al 1999; Hayton et al 2004). The correlation matrix of random data is used to compute eigenvalues; these eigenvalues are then compared to the eigenvalues of the original data. The optimum number of factors is the number of the original data eigenvalues that are larger than the random data eigenvalues. This method adjusts for sampling error and is a sample-based alternative to the K1 rule and scree plot examination. In most studies, one or two of these methods are used, however in this analysis all three are used to ensure the best possible model fit and accurate interpretation of retained factors.

The production of factors through the use of EFA is generally followed by their rotation so as to improve their interpretability and to simplify the factor structure (Thurstone 1935; 1947). Oblique rotation is used as it allows factors to correlate and given that factors within this model form the EC attitude object, it is highly likely that they will correlate. The maximum likelihood EFA fitting procedure is used for this analysis. Though most research typically uses Principal Components Analysis (PCA) or Primary Axis Factoring (PAF) methods of EFA, maximum likelihood allows researchers to test for the statistical significance of and correlations between factors, as well as generating goodness of fit statistics. Gorsuch (1990) has shown important differences between PCA and common factor solutions such as principal axis and maximum likelihood factoring. In such cases, the evidence favours the common factor model as the more accurate. Conway and Huffcutt (2003) therefore urge researchers to make greater use of common factor model approaches (maximum likelihood in particular due to the fit indices that can be used to help determine the number of factors).

Once the optimal number of factors is established and a factor model is generated, this factor structure is specified and tested through CFA. Modification Indices are used to ensure that there are no additional cross loadings that should be accounted for in the model. Goodness of fit indices are also examined to determine how well this model fits the data. Various goodness of fit indices exist and reporting them all would be a hindrance to interpreting the validity of the model. The main index is the chi-square, which should always be reported as it shows the difference between expected and observed covariance matrices (Hu, & Bentler 1999). According to various studies (Hu, & Bentler 1999; MacCallum et al 1996; Yu, 2002) it is best to also report the TLI, CFI, and RMSEA indices should also be reported alongside the chi-square statistic. Both Bayesian and Maximum Likelihood methods of estimation are used in this analysis.

4 RESULTS

Below, the results are divided into two parts: finding the optimal number of factors through examination of factor retention criteria and providing structure for the EC model. The second part of this analysis confirms the fit of the model and provides some initial interpretation of each factor.

4.1 PART ONE

EFA was performed on the nine variables shown in

Table 4, with no restrictions are placed on the model. Various factor retention criteria are reviewed to determine optimal number of factors for the model. Examination of the scree plot shows no single point of inflection and appears to suggest the retention of two, three or possibly four factors. Model comparison statistics were produced in MPLUS and are shown in Table 5, which confirms the conclusions drawn from the scree plot, i.e. that the optimal number of factors lies between two and four (and the difference between a four and five factor model is non-significant).

Table 5: Comparative Model Fit Statistics

Model Comparison	Chi-Square	df	P-Value
1-factor against 2-factor	866.01	8	0.000
2-factor against 3-factor	462.75	7	0.000
3-factor against 4-factor	74.06	6	0.000
4-factor against 5-factor	6.74	5	0.240

Further to this, Table 6 indicates non-significance for four and five-factor models. The remaining possibilities are a two or three-factor model, of which the three-factor model has the lowest chi-square.

Table 6: Model Fit Statistics

Model	Chi-Square	df	P-Value
1-factor	1409.67	27	0
2-factor	543.66	19	0
3-factor	80.91	12	0
4-factor	6.85	6	0.33
5-factor	0.12	1	0.73

Finally, Parallel Analysis (PA) was performed, producing eigenvalues from randomly generated parallel data. If eigenvalues from this parallel data are smaller than those from the original data, then this is indicative of an optimal model. Further to this, according to the K1 factor retention criteria, factors generated from the original data with an eigenvalue >1.0 are to be retained. Thus as shown in Table 7, both the K1 and PA methods of criteria emphasise a three-factor model.

Table 7: Eigenvalues Generated From Original Data And Parallel Data

Factors	Eigenvalues	
	Original Data	***Parallel Data***
1	2.76	1.114
2	1.483	1.083
3	1.116	1.052
4	0.767	1.031
5	0.667	1.016
6	0.615	0.995
7	0.573	0.977
8	0.531	0.961
9	0.487	0.933

4.2 PART TWO

The rotated factor loadings of the three-factor model are displayed in Table 8. Variables with a coefficient above minimum criteria of .3 are highlighted to indicate their contribution to that factor.

Table 8: Variable loadings for three-factor model produced from EFA

Variable	Factor		
	1	2	3
Exaggerated Crisis	**0.598**	0.201	-0.042
Over Populated	-0.121	**0.667**	0.005
Limited Resources	0.02	**0.621**	-0.004
Too Far in Future	**0.725**	0.01	-0.002
Major Disaster	0.235	**0.422**	0.036
Changes to Countryside	0.014	0.056	**0.594**
Beyond Control	**0.522**	-0.168	0.045
Low Priority	**0.509**	-0.005	0.159
Loss of Animal Species	-0.01	-0.005	**0.748**

CFA was performed to test this factor structure. High loading variables (coefficient >.3) were allowed to load freely onto their specific factors, all other loadings were restricted to 0. Before confirming the fit of this model, modification indices were produced. Modification indices report changes in chi-square that occur from freeing fixed parameters, thus determining if there are any potential improvements which could be made to the model. Though it is noted that any modifications made to the model should make theoretical sense, not simply because the analysis indicated for addition or subtraction of a parameter (Schreiber et al 2010).

Table 9: Modification Indices for CFA

	Variable	M.I.
F1	*Over Populated*	77.29
F1	*Major Disaster*	136.68
F2	*Exaggerated Crisis*	72.26
F2	*Too Far in Future*	13.18
F2	*Beyond Control*	61.09
F3	*Too Far in Future*	14.17
F3	*Major Disaster*	26.05
F3	*Low Priority*	32.7

Table 9 shows several potential improvements to the model by incorporating additional parameters. A considerable improvement to the model can be achieved by allowing the Major Disaster variable to load freely onto factor one.

An initial loading of .235 demonstrates that the Major Disaster variable contributes to factor one, though this was just below the arbitrary loading criteria. Theoretically, this factor is

complex, and so it is difficult to determine whether this variable makes theoretical sense for factor one. Initial interpretation is that this factor seems to show a complex attitude towards the environment, one which seems to reflect extreme concern for environmental problems (Beyond Control), while at the same time scepticism over its exact nature of their severity (Exaggerated Crisis) as well as a desire not to act imminently (Low Priority and Too Far in Future). Including the Major Disaster variable in factor one would not alter this, and is similar in nature to the Beyond Control variable. Overall, given that the Major Disaster variable already contributes to factor one, the modification index is particularly high and as its inclusion does not compromise the theoretical interpretation of the mode, this variable is allowed to load freely onto factor one.

The final model displayed in Table 10 reports variable loadings for the CFA model. Maximum likelihood method of parameter estimation was used to produce this table. Bayesian estimation was also used and confirmed the results in Table 10 (see appendix for the Bayesian output). These factors are named and interpreted below.

Table 10: Standardised CFA Results of Final EC Model

	Variable	Estimate	S.E.	P-Value
F1	*Exaggerated Crisis*	1.000	0.000	-
	Too Far in Future	1.100	0.051	0.000
	Beyond Control	0.624	0.043	0.000
	Low Priority	0.832	0.043	0.000
	Major Disaster	0.400	0.034	0.000
F2	*Major Disaster*	1.000	0.000	-
	Limited Resources	1.763	0.167	0.000
	Over Populated	1.667	0.140	0.000
F3	*Changes to Countryside*	1.000	0.000	-
	Loss of Animal Species	0.936	0.065	0.000

Factor 1 – *Paradoxical Concern*

As previously remarked upon, factor 1 is a complex factor and reflects on an attitudes with three key aspects:

- General environmental concern (Major Disaster, Beyond Control)
- Scepticism (Exaggerated Crisis)
- Desire not to act in response to climate change at present (Low Priority, Too Far In The Future)

Given this odd combination of variables this factor has been labelled as a paradoxical form of concern.

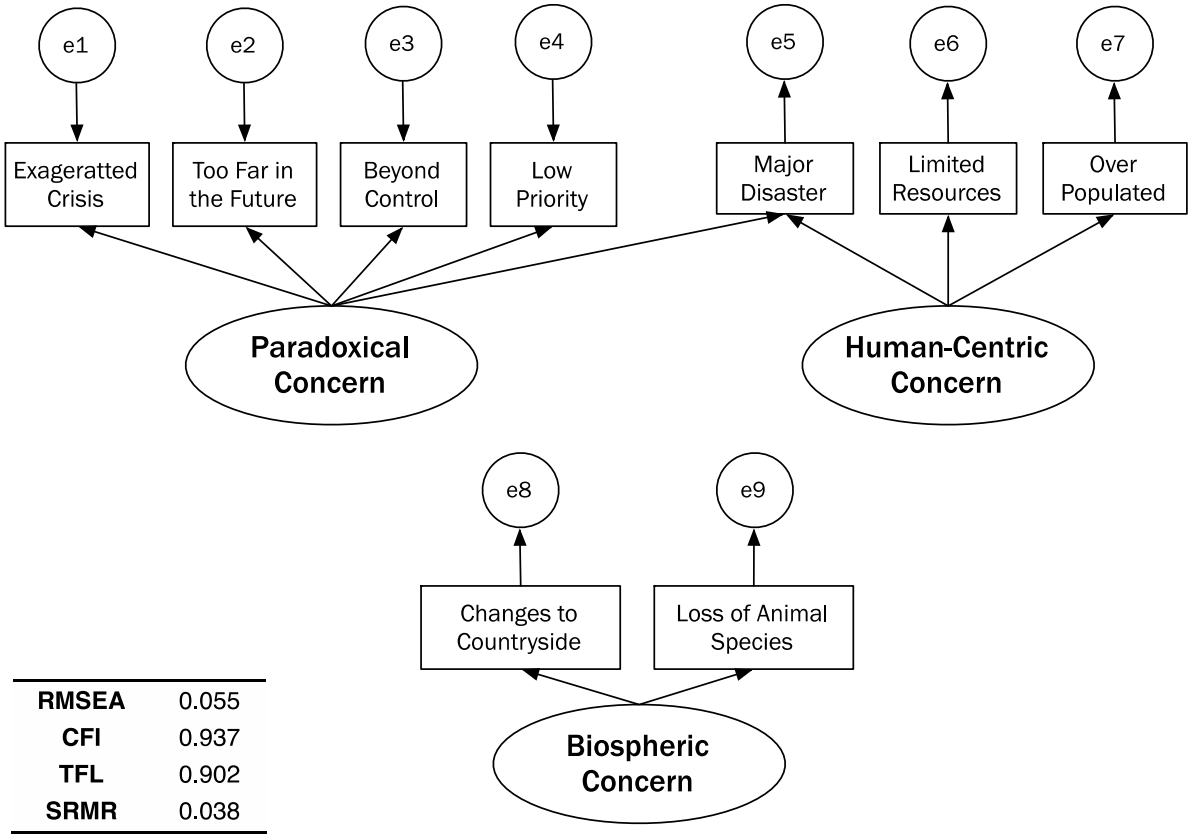
Factor 2 – *Human-Centric Concern*

The Over Populated and Limited Resources variables together indicate an EC with respect to the human population, specifically their impact on the planet and its ability to sustain them.

Factor 3 – *Biospheric Concern*

This factor demonstrates a distinct biospheric component, capturing concern for both animal species and countryside.

Figure 2 shows the final diagram and its goodness of fit statistics. CFI, TFL and SRMR statistics all indicate good fit, however the RMSEA should ideally be >0.05, indicating a borderline result.



RMSEA	0.055
CFI	0.937
TFL	0.902
SRMR	0.038

Figure 2: Diagram of the Final Environmental Concern Model and Goodness of Fit Indices

5 DISCUSSION

5.1 THE MODEL OF ENVIRONMENTAL CONCERN

The aim of this paper is to investigate the VBN through the use of nationally representative data that obtained without a priori commitment to any particular theory, but which includes question scales that provide the opportunity for factor loadings supportive of the VBN to emerge. Indeed it was hypothesised that some or all VBN components would emerge, given that variables that reflect VBN components were included, along with additional variables that reflect EC or anti EC more generally. Thorough examination of various criteria and

indices has led to the identification of a three-factor model of EC. This model has similarities with those produced by Stern and Dietz (Stern, & Dietz 1994) as well as some important differences.

The most intriguing component of the model is the paradoxical combination of variables that load highly onto factor one. This paradoxical response can easily be interpreted as conforming, in a sense, to the egoistic component of the VBN, as it reflects a valuation of the self above that of other people and other living things. Alternatively, we suggest that those who score highly on this factor may be exhibiting a form of denial or resignation, where an expressed lack of EC is used as a coping mechanism in the face of numerous environmental problems.

Factor two closely corresponds to the social altruistic component of the VBN model. The variable loadings of this factor suggest recognition of society's environmental impact, though the focus is on Earth's ability to continue meeting growing needs of this population. Due to the limitations of the data, this factor not altruistic in the sense intended by Stern (1994): the variables that have loaded onto this factor appear to indicate a concern for the Earth's ability to continue meeting the needs of human society rather than a concern for the welfare of society. Therefore due to the lack of solely altruistic variables in the EAS data, this factor has been labelled here as Human Centric.

The final factor reflected a biospheric concern. Overall therefore, results do largely support the VBN model, though the paradoxical factor does need to be considered in more detail. Paradoxical concern could potentially be a variant of the egoistic component; captured a new attitude derived from egoistic value orientation. Though it is too soon to determine if this is an improvement on the VBN, further examination of this form of EC and its place within the VBN theoretical model is required. Although we must at this stage be tentative, if further research confirms this factor structure then understanding the drivers of high scorers might hold the key to shifting human environmental behaviour.

5.2 Reflections on The Data

Defra's Environmental Attitude Survey is intended to measure environmental attitudes, norms, values and behaviours, including barriers to pro-environmental behaviour. The survey is not intended to embody a particular theoretical commitment but nonetheless does appear to be influenced by the dominant models. The 2009 EAS was skewed more towards measuring specific environmental behaviours than values and norms. Where the latter were measured, the terms were not those of pre-validated scales, though there were sufficient similarities for to meaningfully relate the results to the VBN framework. The results produced from the analysis of the EAS provide broad support for the VBN, in that the factors found could conceivable be attitudes of EC derived from the three value orientations outlined by the VBN.

Our analysis suggests that there is value to this dataset in terms of its ability to characterise EC in the UK. Longitudinal maintenance of the EAS would enhance this value by allowing for the use of longitudinal methods of data analysis. The progression of EC over time could then be captured providing further benefit to the study of EC. Longitudinal analysis is particularly appropriate, given that attitudes are not static. This fluidity is exacerbated for attitudes relating to nature, as EC attitudes alter with environmental change and as such are continually being transformed Stern (2000).

The 2009 EAS is part of a series of public attitude surveys run by DEFRA. Unfortunately, data from the majority of previous waves cannot be obtained. Cohorts with available data are conducted rarely and infrequently. If longitudinal maintenance for the EAS were improved, a case could be made for the additional inclusion of an abbreviated value scale such as the revised NEP scale. The intention would be to measure perceptions growth limitation, anti-anthropocentrism, the fragility of nature's balance, rejection of humans being exempt from natural conditions and the possibility of an eco-crisis (Wurzinger, & Johansson 2006). This not only would facilitate a greater comprehension of the environmental values that provide the basis for EC attitudes, but with known group validity (i.e. the ability to distinguish between known environmentalists and non-environmentalists), the NEP scale should facilitate segmentation. Indeed, if it is assumed that values are relatively stable, then given this stability, values could be a tool for classification with which to segment the population into typologies (something that we will address in further work). Further to this, the implications for the study of the relationship between EC attitudes and pro-environmental behaviour should be considered. Many studies have also shown the NEP to have some predictive validity, in the sense of significant relationships having been found between the NEP Scale and various types of behavioural intentions, both self-reported and observed (Dunlap et al 2000). At the very least, possibilities such as this arguably deserve closer attention by national commissioning authorities.

5.3 Further Research

There are initially two ways in which the work presented here could be extended. Firstly, alternative statistical methods could be employed. Bayesian Structural Equation Modelling (BSEM) is a new method of performing CFA, one more nuanced and reflective of the data. This uses Bayesian estimation and uses prior information from EFA to increase the variance of certain cross-loadings while keeping the mean at 0. However, factor analysis more broadly may not be the most suitable methods for understanding EC. Using factor analysis imposes the assumption that attitudes are continuous in nature and exist on a scale. The strength of an individual's attitude is dictated by the position on the scale. Individuals can therefore hold a combination of attitudes in varying quantities. An alternative approach is to assume that attitudes towards a particular concept have a higher level of mutual exclusivity. Or that values, given their high level of stability, can be used as a classification system. In either case, individuals could potentially be segmented according to their attitudes and / or values. If this were the class, a superior method of analysing EC may be Latent Class Analysis (LCA). LCA models identify a categorical latent class variable measured by a number of observed response variables. The objective is to categorize people into classes using the observed items, and identify items that best distinguish between classes.

A second means of extending this work is through qualitative research. It is acknowledged that quantitative methods of analysis may not be able to fully capture all aspects of EC. Qualitative research could provide a greater level of insight into the mechanisms of EC and justifications for why portions of the population adhere to the EC components uncovered in the paper. In particular, it would seem of value to investigate the psychological processes leading to a high score on the paradoxical factor.

5.4 Final Reflections on Escaping the Dominance of the VBN Framework

If a survey is not specifically designed to test or illustrate some VBN-based theory, then it is no longer inexorable that the analytical process will lead to good VBN-based model fit. This provides the opportunity to explore the nature of EC, freed from some of the constraints that

the VBN brings, both explicitly and implicitly. As alluded to in the introduction, the topic of theory testing raises issues that are treated as fundamental in the philosophy of science. It is now half a century since Kuhn (1962) and Feyerabend (1962) addressed the issue of commensurability and incommensurability among alternative theoretical paradigms and theories, with Feyerabend in particular motivated by a concern that dominant scientific paradigms can suppress alternative ways of thinking. For Feyerabend, the extent of commensurability between theories is ultimately a matter of interpretation.

Of course, here we have not moved far beyond the VBN at all, relying on familiar attitude theory and analytic methods. We have found a paradoxical factor which is potentially of some policy import but this hardly constitutes a counter thesis. Nonetheless, we have shown that there is value in stepping outside of a dominant way of thinking. We have not sought to provide some independent test of the VBN theory, though one could interpret our exploration as providing some form of test and one that the VBN passes in a qualified way.

6 BIBLIOGRAPHY

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7 APPENDIX

Table 11: Standardised variable loadings for CFA using Bayesian estimation

	Variable	Estimate	Posterior S.D.	P-Value	Lower 2.5%	Upper 2.5%
F1	*Exaggerated Crisis*	1.000	0.000	0.000	1.000	1.000
	Too Far in Future	1.092	0.045	0.000	1.009	1.184
	Beyond Control	0.900	0.040	0.000	0.820	0.977
	Low Priority	0.707	0.038	0.000	0.634	0.781
	Major Disaster	0.463	0.037	0.000	0.393	0.537
F2	*Major Disaster*	1.000	0.000	0.000	1.000	1.000
	Limited Resources	1.850	0.169	0.000	1.575	2.228
	Over Populated	1.677	0.139	0.000	1.410	1.998
F3	*Changes to Countryside*	1.000	0.000	0.000	1.000	1.000
	Loss of Animal Species	1.006	0.073	0.000	0.882	1.152