Preservation and Utilization: Understanding the Structure of Environmental Attitudes[1]

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Abstract

The dimensionality of environmental attitudes is a still unresolved theoretical and empirical issue. This research addressed this issue by testing a model derived from prior findings suggesting that environmental attitudes are organized in a hierarchical fashion, with first-order factors loading on either one of two correlated second-order factors, namely Preservation and Utilization. The new 12-scale Environmental Attitudes Inventory (EAI) was used to assess environmental attitudes comprehensively in a sample of 314 psychology undergraduate students. The findings supported this hierarchical structure. Discriminant validity for the two higher-order factors was also demonstrated by showing that Preservation predicted self-reported ecological behaviour, whereas Utilization predicted attitudes toward economic liberalism.
Key-words: environment attitudes, dimensionality, preservation, utilization, Environmental Attitudes Inventory, confirmatory factor analysis

Preservacióin y Utilización: La estructura de las actitudes ambientales

Resumen

La dimensionalidad de las actitudes ambientales es una cuestión aún no resuelta teórica y empíricamente. Esta investigación se dirigió en esta dirección, poniendo a prueba un modelo derivado de resultados previos que sugieren que las actitudes ambientales están organizadas de manera jerárquica, con factores de primer orden que cargan sobre dos factores correlacionados de segundo

orden, a saber Preservación y Utilización. El nuevo Inventario de Actitudes Ambientales de 12 escalas (EAI) fue aplicado a una muestra de 314 estudiantes de psicología para evaluar actitudes ambientales. Las conclusiones apoyaron esta estructura jerárquica. La validez discriminante también fue demostrada para los dos factores de orden superior, mostrando que Preservación predice el comportamiento ecológico autoinformado, mientras que Utilización predice las actitudes hacia el liberalismo económico.

Palabras clave: Actitudes ambientales, dimensionalidad, preservación, Inventario de actitudes ambientales, análisis factorial confirmatorio

Introduction

Earth's natural resources are under severe threat. It has been estimated that approximately 60 percent of the ecosystem services that support life on Earth (i.e., fresh water, capture fisheries, air and water regulation, and the regulation of regional climate, natural hazards and pests) are being degraded or used unsustainably (Millennium Ecosystem Assessment, 2005).

Psychologists have long recognised that environmental problems are produced by maladaptive human behaviour (Maloney & Ward, 1973). Recently, Oskamp (2000) has argued that "[h]uman actions are producing many harmful and possibly irreversible changes to the environmental conditions that support life on Earth" (p. 496). The solution of these problems may depend on obtaining an understanding of people's attitudes toward the environment.

This article discusses the dimensionality of environmental attitudes. We argue that understanding how people's environmental attitudes are cognitively organised is a crucial topic, and possibly the first step to promoting attitude and behaviour change. In the following section, a conceptual definition of environmental attitudes is presented, and a brief overview is given of theoretical approaches to the dimensionality of environmental attitudes. Finally, research is reported that supports earlier findings by Milfont and Duckitt (2004), indicating that environmental attitudes seem to be hierarchically structured around two correlated higher-order factor.

Environmental attitudes and the issue of their dimensionality

Environmental attitudes (EA) can be defined as "the collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues" (Schultz, Shriver, Tabanico, & Khazian, 2004, p. 31). Many studies have demonstrated that EA seem to predict ecological behaviour (see, e.g., Hines, Hungerford, & Tomera, 1987; Kaiser, Wölfing, & Fuhler, 1999; Martimportugués, Canto, García, & Hidalgo, 2002). However, the effect sizes have been found to be only low to moderate in terms of magnitude (Bamberg, 2003). This "gap" between environmental attitudes and behaviour (Guber, 1996) may be due to the dimensionality of EA not yet being adequately clarified.

Researchers have been trying to understand the dimensionality of many psychological constructs, such as personality (Costa & McCrae, 1992; Eysenck, 1992), values (Schwartz, 1992; Schwartz & Bilsky, 1987), social attitudes (Saucier, 2000), time perspective (Milfont, Andrade, Belo, & Pessoa, 2005; Zimbardo & Boyd, 1999), and social axioms (Leung & Bond, 2004). Better understanding how people's psychological constructs are cognitively organised enables better prediction of behaviour. Therefore, the study of the dimensionality of EA might enable the promotion of both attitude and behaviour change. Even though the dimensionality of EA has not yet been empirically resolved (Dunlap & Jones, 2002), some important theoretical approaches have been proposed.

Broadly, there seem to be two main approaches to the dimensionality of EA. One approach sees EA as a unidimensional, bipolar construct. In this traditional approach, EA are seen to range from *unconcerned* about the environment at the low end to *concerned* about the environment at the high end (Pierce & Lovrich, 1980; Poortinga, Steg, & Vlek, 2002; Schultz, 2000). Proponents of this approach have measured EA using the New Environmental Paradigm (NEP) scale (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones, 2000).

A second approach has seen EA as a multidimensional construct related to value-based orientations. The value-based orientations can have either two or three dimensions. In the two-dimensional tradition, EA are classified as rooted in either a concern for all living things (*ecocentric* concern) or in a concern for humans (*anthropocentric* concern). These two concern dimensions are typically measured using Thompson and

Barton's (1994) scales. The three-dimensional tradition is based on Stern and Dietz's (1994) theory of the value basis of environmental concern. In this theory, Schwartz's (1977) norm-activation model of altruism is expanded, and a tripartite classification of value orientations towards environmental concern are presented. EA are categorised as rooted in a concern for the self (*egoistic* concern), for other people (*altruistic* concern) or for the biosphere (*biospheric* concern). The tripartite model has usually been measured using Schwartz's (1992) value items (Stern, Dietz, & Guagnano, 1995; Stern, Dietz, Kalof, & Guagnano, 1995), or using Schultz's (2001) Environmental Motives Scale (Milfont, Duckitt, & Cameron, 2005; Schultz et al., 2005).

Bogner and his colleagues (Bogner, Brengelmann, & Wiseman, 2000; Bogner & Wiseman, 1997, 1999; Wiseman & Bogner, 2003) have tried to evaluate the dimensionality of EA empirically by conducting second-order factor analysis. In line with the two-dimensional tradition, Wiseman and Bogner (2003) proposed a Model of Ecological Values (MEV) with two orthogonal dimensions: *Preservation* and *Utilization*. They argued that ecological values are established by "one's position on two orthogonal dimensions, a biocentric dimension that reflects conservation and protection of the environment (Preservation); and an anthropocentric dimension that reflects the utilization of natural resources (Utilization)'' (Wiseman & Bogner, 2003, p. 787).

In a more extensive investigation, Milfont and Duckitt (2004) evaluated the structure of EA by factor analysing 99 items from well-know EA measures. The results from both exploratory and confirmatory factor analysis showed that the EA were organized in a hierarchical structure. These were ten first-order factors that loaded on one of two correlated second-order factors. Their findings indicated that Preservation and Utilization were strongly correlated and not orthogonal, as proposed by the MEV.

Although purely empirically based, Milfont and Duckitt's (2004) findings are consistent with a number of theories. These theories have argued that people-environment relations can be viewed in terms of two distinct beliefs that are very similar to these Preservation and Utilization dimensions (Corral-Verdugo & Armendáriz, 2000; Dobson, 1998; Dunlap & Jones, 2002; Dunlap & Van Liere, 1978; Kortenkamp & Moore, 2001; Thompson & Barton, 1994). For example, these Preservation and

Utilization dimensions seem to be related, respectively, to the spiritual and instrumental views of people-environment relations (Stokols, 1990). According to Stokols (1990), the spiritual view sees the environment as an end in itself, whereas the instrumental view sees the environment as a means for human objectives. Kaiser and Fuhler (2003) have also argued that "if the evaluative component of people's attitudes consists of at least two distinguishable lines of values—utilitarian values as well as moral/altruistic ones—then it would be better to consider them independently" (p. 1041). Therefore, EA can be seen as rooted in two philosophical or ideological principles that would be expressed in two correlated higher-order environmental value dimensions.

The present study

As described above, Milfont and Duckitt's (2004) findings indicated that ten first-order EA factors loaded on one of two correlated second-order factors. However, one criticism of their findings is that their item pool of 99 items did not include items tapping overpopulation. The world's population has doubled between 1960 and 2000 (Millennium Ecosystem Assessment, 2005), and population growth has been presented as a central issue to the environmental problems literature (Bandura, 2002; Van Liere & Dunlap, 1981). In addition, one of their first-order factors (Factor 2, External control/effective commitment) comprised a subset of items loading very weakly on the factor, and it was later shown to contain two subdimensions. And finally, the items that loaded on their ten first-order factors did not formed balanced scales, and so were not adequately controlled for acquiescence response bias. The aim of the current study was therefore to extend Milfont and Duckitt's (2004) findings by refining their factor analytic scales, and to test their proposed hierarchical structure of EA in a different sample.

To remedy the faults presented above, the Environmental Attitudes Inventory (EAI) was developed by refining Milfont and Duckitt's original factor analytic scales to balance them so that each scale had equal number of pro and contrait items, adding a scale to assess population growth, and splitting the problematic factor into two scales. In brief, the EAI assesses broad beliefs about the humans-natural environment relationship, and was designed to operationalise the hierarchical structure of EA by measuring twelve specific facets, or primary factors,

that define the two higher-order factors of the environmental attitudes. The twelve primary factors are measured using balanced scales. The scales' names, construct definitions, and content similarities with prior environmental attitudes measures are shown in Table 1.

Table 1. The Environmental Attitudes Inventory scales, and their construct definition and content similarities with prior environmental attitudes measures

Scale Label	Construct Definition	Content similarities with prior environmental attitudes measures
Scale 01. *Enjoyment of Nature*	Belief that enjoying time in nature is pleasant, and it is preferred to spending time in urban areas, versus belief that enjoying time in nature is dull, boring and not enjoyable and a preference for spending time in urban areas.	- Thompson and Barton's (1994) ecocentric scale - Bogner and Wiseman's (1999) enjoyment of nature subscale - Mayer and Frantz's (2004) connectedness to nature scale
Scale 02. *Support for Interventionist Conservation Policies*	Support for conservation policies regulating industry and the use of raw materials, and subsidising and supporting alternative eco-friendly energy sources and practices, versus opposition to such measures and policies.	- Blaikie's (1992) sacrifices for the environment and conservation of natural resources subscales - Klineberg, McKeever, and Rothenbach's (1998) economic costs or government regulations items
Scale 03. *Environmental Movement Activism*	Personal readiness to actively support or get involved in organized action for environmental protection, versus disinterest in or refusal to support or get involved in organized action for environmental protection.	- Lounsbury and Tornatzky's (1977) environmental action dimension - Bogner and Wiseman's (1999) intent of support subscale - Iwata's (2001) approach to information on environmental problems factor
Scale 04. *Conservation Motivated by Anthropocentric Concern*	Support for conservation policies and protection of the environment motivated by anthropocentric concern for human welfare and gratification, versus support for such policies motivated by concern for nature and the environment as having value in themselves.	- Thompson and Barton's (1994) anthropocentric scale
Scale 05. *Confidence in Science and Technology*	Belief that human ingenuity, especially science and technology, can and will solve all environmental current problems and avert or repair future damage or harm to the environment, versus belief that human ingenuity, especially science and technology, cannot solve all environmental problems.	- Blaikie's (1992) confidence in science and technology subscale - Grob's (1995) perceived control third subcomponent - Dunlap, Van Liere, Mertig and Jones' (2000) rejection of exemptionalism facet
Scale 06. *Environmental Threat*	Belief that the environment is fragile and easily damaged by human activity, and that serious damage from human activity is occurring and could soon have catastrophic consequences for both nature and humans, versus belief that nature and the environment are robust and not easily damaged in any irreparable manner, and that no damage from human activity that is serious or irreparable is occurring or is likely.	- Dunlap et al.'s (2000) the reality of limits to growth, the fragility of nature's balance, and the possibility of an ecocrisis facets - Klineberg et al.'s (1998) ecological worldview items

Scale 07. *Altering Nature*	Belief that humans should and do have the right to change or alter nature and remake the environment as they wish to satisfy human goals and objectives, versus belief that nature and the natural environment should be preserved in its original and pristine state and should not be altered in any way by human activity or intervention.	- Bogner and Wiseman's (1999) human dominance, and altering nature subscales
Scale 08. *Personal Conservation Behaviour*	Taking care to conserve resources and protect the environment in personal everyday behaviour, versus lack of interest in or desire to take care with resources and conserve in one's everyday behaviour.	- Bogner and Wiseman's (1999) care with resources subscale
Scale 09. *Human Dominance Over Nature*	Belief that nature exists primarily for human use, versus beliefs that humans and nature has the same rights.	- Albrecht, Bultena, Hoiberg and Nowa's (1982) man over nature dimension - Blaikie's (1992) use/abuse of the natural environment subscale - Dunlap et al.'s (2000) antianthropocentrism facet - Iwata's (2001) rejection of driving one's own car factor - La Trobe and Acott's (2000) humans and economy over nature factor - Klineberg et al.'s (1998) ecological worldview scale
Scale 10. *Human Utilization of Nature*	Belief that economic growth and development should have priority rather than environmental protection, versus belief that environmental protection rather than economic growth and development should have priority.	- Buttel and Flinn's (1976) support for economic growth scale - Weigel and Weigel's (1978) environmental concern scale items - Klineberg et al.'s (1998) economic costs or government regulations items
Scale 11. *Ecocentric Concern*	A nostalgic concern and sense of emotional loss over environmental damage and loss, versus absence of any concern or regret over environmental damage.	- Thompson and Barton's (1994) ecocentric scale - Dunlap et al.'s (2000) rejection of exemptionalism facet
Scale 12. *Support for Population Growth Policies*	Support for policies regulating the population growth and concern about overpopulation, versus lack of any support to such policies and concern.	- Tognacci, Weigel, Wideen and Vernon's (1972) individual population control, and overpopulation scales - Braithwaite and Law's (1977) overpopulation facet - Van Liere and Dunlap's (1981) population scale

As can be seen, all twelve primary factors are coherent with prior research. In the EAI measurement model, seven first-order factors (i.e., Scales 01, 02, 03, 06, 08, 11, and 12) comprise the Preservation second-order factor, while five first-order factors (i.e., Scales 04, 05, 07, 09, and 10) comprise the Utilization second-order factor.

The discriminant validity of the two second-order factors was also assessed. The Preservation dimension prioritizes preserving nature and the diversity of natural species in its original natural state, and protecting it from human use and alteration; whereas the Utilization dimension expresses the belief that it is right, appropriate and necessary for nature and all natural phenomena and species to be used and altered for human objectives. We expected therefore that Preservation would predict ecological behaviour, while Utilization would predict economic liberalism, which represents aspects of the Dominant Social Paradigm (Dunlap & Van Liere, 1978; Kilbourne, Beckmann, & Thelen, 2002). These predictions are in line with Milfont and Duckitt's (2004) results.

Method

Participants and Procedure

An anonymous questionnaire was administrated to students enrolled in introductory psychology classes at the University of Auckland, New Zealand. More than 95% of the students present in the classes agreed to participate. A total of 314 (215 female and 99 male) students completed the questionnaire. Their ages ranged from 16 to 51 (M = 20; $S.D.$ = 4.48).

Instruments

The following measures, along with questions assessing demographic information (e.g., age, gender), comprised the questionnaire. The responses to all measures were given on a 7-point Likert rating scale, raging from 1 (*strongly disagree*) to 7 (*strongly agree*), except as noted.

Environmental Attitudes Inventory (EAI). This comprised a balanced set of 120 items that were selected to assess twelve environmental attitude primary factors (see Appendix). Milfont and Duckitt (2005) have reported on the preliminary instrument development of the EAI.

Ecological Behaviour. This scale consists of 8 items previously used by Schultz and colleagues (Schultz & Zelezny, 1998; Schultz, Zelezny, & Dalrymple, 2000), which were selected to provide a measure of self-reported ecological behaviour. Participants were asked to indicate how often they had engaged in each of eight specific behaviours in the last year (looked for ways to reuse things, recycled newspaper, recycled cans or bottles, encouraged friends of family to recycle, purchased products in reusable or recyclable containers, picked up litter that was not your own,

composted food scraps, conserved gasoline by walking or bicycling) on a five-point rating scale from 1 (*never*) to 5 (*very often*). The alpha coefficient was .69 for this 8-item scale version. The average score was 3.30 (*S.D.* = .67), with women (*M* = 3.39, *S.D.* = .63) scoring significantly higher than men (*M* = 3.09, *S.D.* = .71), *t* (312) = 3.82, *p* < .001, two-tailed, *d* = .45.

Economic Liberalism Scale. This measure assesses people's attitudes toward economic liberalism. It is a 3-item scale (Individual behaviour should be determined by economic self-interest, not politics; The best measure of progress is economic; and If the economy continues to grow, everyone benefits) that had been developed to assess the economic dimension of the Dominant Social Paradigm (Kilbourne et al., 2002). In this study, the alpha coefficient was .65, and the average score was 3.32 (*S.D.* = 1.02), with no significant gender difference.

Data analyses

Confirmatory factor analyses (CFAs) with maximum-likelihood estimation procedures were used to test the goodness of fit of the models. The ratio of chi-square to degree of freedom (x^2/df), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the Comparative Fit Index (CFI) were used to evaluate model fit. Models with a x^2/df ratio in the range of 2 to 3, and RMSEA, SRMR and CFI respectively having values close to .06, .08, .95 and .95 or better were considered as presenting an acceptable fit (Carmines & McIver, 1981; Hu & Bentler, 1999). The x^2 difference test, the Target Coefficient (*T*, Marsh & Hocevar, 1985), the Expected Cross-Validation Index (ECVI), and the Consistent Akaike Information Criterion (CAIC) were also used to calculate significant improvements over competing models. Significant results of the x^2 difference test, higher T values, and lower ECVI and CAIC values reflect the model with the better fit (Garson, 2003; Marsh & Hocevar, 1985).

Results

First, the factor structure of the EAI was tested. To do this, three manifest indicators, consisting of item parcels, were used for each one of the twelve scales. These manifest indicators were created by randomly assigning the 10 items from each primary factor scale to their three

parcels, with pro and contrait items equally represented in each parcel, so as to have balanced indicators. The factor structure of the EA first-order factors was then examined by CFA. The fit indices for the 12 factor model indicated very good fit (x^2 = 810.97; df = 528; x^2/df = 1.54; RMSEA = .041; SRMR = .048; CFI = .98), which supported the hypothesized 12 factor structure of the EAI.

As the factorial structure of the 12 EAI scales was confirmed, the scales' intercorrelations, descriptive statistics, internal reliability and possible gender differences were assessed. These are shown in Table 2. All the scales had adequate reliability, with alpha coefficients raging from .74 (Scale 4) to .89 (Scale 3) (M = .84). There were gender differences on five scales. Women scored significantly higher ($p < .05$) than men on Scales 02 (Support for Interventionist Conservation Policies), 03 (Environmental Movement Activism), 08 (Personal Conservation Behaviour), and 11 (Ecocentric Concern). Men, in contrast, scored marginally significantly higher ($p < .10$) than women on Scale 10 (Human Utilization of Nature).

Next, the EAI higher-order factorial structure was assessed by CFAs with maximum-likelihood estimation procedures using the same item parcels described previously. Two models were estimated. The first model had a one-factor second-order structure, reflecting the traditional view of EA as a unidimensional construct. The second model had two correlated second-order factors, Preservation and Utilization, that is in line with Milfont and Duckitt' (2004) findings. In the second model seven first-order factors (Scales 01, 02, 03, 06, 08, 11, and 12) loaded on the Preservation second-order factor, and five first-order factors (Scales 04, 05, 07, 09, and 10) on the Utilization second-order factor. The fit indices for the two models are reported in Table 3. The correlated two-factor second-order structure had good fit for the data. All parameters were significant ($t > 1.96$, $p < .05$), and all loadings were high (the weakest standardised path was .39 from Utilization to Scale 05). The two higher-order factors (i.e., Preservation and Utilization) were highly correlated (F = -.87). This model was tested against the one-factor second-order structure. The correlated two-factor second-order structure was statistically better fitting [x^2(1) = 51.02, $p < .001$], and had a better overall fit indices then the single second-order factor structure, although the single factor model also had good fit.

Table 2. Means, standard deviations, reliabilities, and intercorrelations of the Environmental Attitude Inventory (EAI) scales

Factors	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Scale 01	4.88	1.01	(0.87)											
2. Scale 02	5.39	.89	.37***	(0.87)										
3. Scale 03	4.56	1.06	.44***	.40***	(0.89)									
4. Scale 04	3.81	.82	-.21***	-.35***	-.31***	(0.74)								
5. Scale 05	3.73	.83	-.05	-.27***	-.12*	.28***	(0.84)							
6. Scale 06	5.05	.89	.30***	.58***	.48***	-.33***	-.28***	(0.87)						
7. Scale 07	4.10	.77	.31***	.34***	.38***	-.35***	-.24***	.38***	(0.75)					
8. Scale 08	4.67	.91	.38***	.30***	.41***	-.20**	-.08	.35***	.33***	(0.80)				
9. Scale 09	3.13	1.04	-.30***	-.37***	-.40***	.41***	.25***	-.42***	-.37***	-.37***	(0.87)			
10. Scale 10	3.44	.80	-.28***	-.44***	-.52***	.46***	.30***	-.50***	-.45***	-.32***	.56***	(0.86)		
11. Scale 11	5.40	.88	.41***	.53***	.51***	-.35***	-.26***	.60***	.38***	.39***	-.54***	-.57***	(0.88)	
12. Scale 12	3.87	1.00	.14*	.27***	.23***	-.27***	-.04	.40***	.29***	.19**	-.23***	-.39***	.33***	(0.85)

Note. The Cronbach's alphas appear on the diagonal.
Scale labels: Scale 01 - Enjoyment of Nature, Scale 02 - Support for Interventionist Conservation Policies, Scale 03 - Environmental Movement Activism, Scale 04 - Conservation Motivated by Anthropocentric Concern, Scale 05 - Confidence in Science and Technology, Scale 06 - Environmental Threat, Scale 07 - Altering Nature, Scale 08 - Personal Conservation Behaviour, Scale 09 - Human Dominance Over Nature, Scale 10 - Human Utilization of Nature, Scale 11 - Ecocentric Concern, and Scale 12 - Support for Population Growth Policies.
* $p < .05$, ** $p < .01$, *** $p < .001$. Two-tailed.

Table 3. Fit indices for alternative models

Model	x^2	df	x^2/df	RMSEA	SRMR	CFI	T	ECVI	CAIC
One higher-order factor	997.88	582	1.71	.048	.064	.98	.813	3.72	1564.83
Two higher-order factors	946.86	581	1.63	.045	.061	.98	.856	3.57	1520.56

Note. N = 314. x^2/df – the ratio of chi-square to degree of freedom; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual; CFI – Comparative Fit Index; T – Target Coefficient; ECVI – Expected Cross-Validation Index; CAIC – Consistent Akaike Information Criterion.

Finally, the discriminant validity of the proposed model was assessed by the relationship between the two higher-order dimensions and both ecological behaviour and economic liberalism. The discriminant-validity model had good overall fit for the data (x^2 = 1613.94; df = 1017; x^2/df = 1.59; RMSEA = .043; SRMR = .064; CFI = .97). This model is shown in Figure 1. In line with Milfont and Duckitt' (2004) findings, the path from Preservation to ecological behaviour was powerful and significant (ß = .93, *p* < .05), but that to economic liberalism was not significant (ß = .00, *p* > .05). On the other hand, the path from Utilization to economic liberalism was powerful and significant (ß = .71, *p* < .05), but not that to ecological behaviour (ß = .29, *p* > .05).
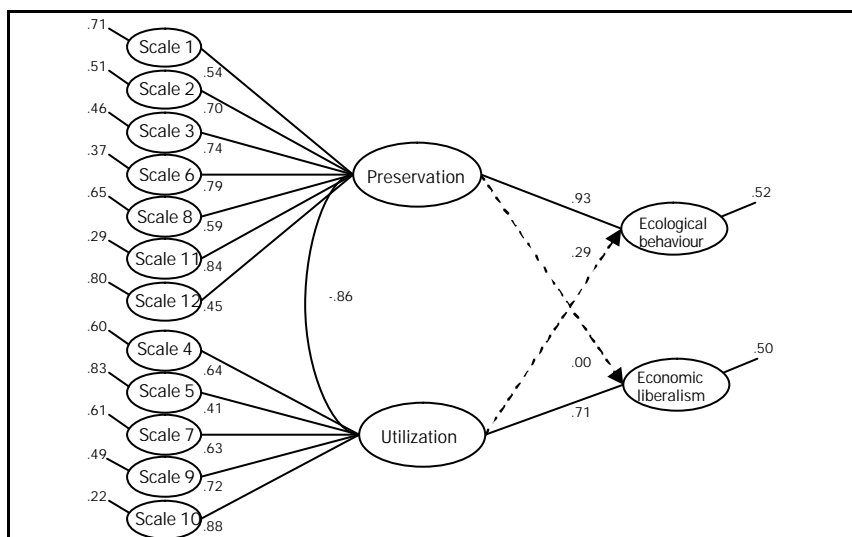

Figure 1. Standardized multiple regression and correlation coefficients for the structural equation model of environmental attitude's twelve first-order factors, two second-order factors and self-reported ecological behaviour and economic liberalism.

Discussion

This study set out to test the correlated two factor higher-order structure of EA, and assess the discriminant validity of these two factors, previously identified by Milfont and Duckitt (2004). It did so using the fully balanced twelve EAI scales, which would therefore extend their earlier findings which were based on only 10 primary factors, and were not fully balanced to control direction of wording effects. The results support Milfont and Duckitt's (2004) prior findings by demonstrating a hierarchical structure of EA with twelve primary factors, and two correlated second-order factors. The CFA results supported the two-factor second-order structure of the EA by showing that this model provided the best fit to the data and was statistically better fitting than a one-factor second-order model. It is important to note, however, that the difference between these two models was not great, the single factor model also had good fit, and the two second-order factors (i.e., Preservation and Utilization) were highly correlated.

The correlation between these two higher-order factors seems to threaten the independence of the factors. In other words, they are so strongly related that they could express a unidimensional, bipolar EA construct, rather then a bi-dimensional construct, where Preservation and Utilization are its end-points. As discussed before, this is the traditional view of the dimensionality of the EA (Dunlap et al., 2000; Pierce & Lovrich, 1980; Poortinga et al., 2002; Schultz, 2000). Therefore, although theoretically meaningful, the independence between Preservation and Utilization must be tested empirically by showing that they predict external variables differently.

These findings supported the discriminant validity of the two higher-order factors. Preservation predicted ecological behaviour, while Utilization predicted economic liberalism. Therefore, the results support the two-dimensional approach to the dimensionality of the EA, in which EA seems to be rooted in two higher-order sets of environmental values (Thompson & Barton, 1994; Wiseman & Bogner, 2003). However, it should be noted that evidence of discriminant validity of the two higher-order EA dimensions is limited. As noted by an anonymous reviewer, the covariance between the two higher-order factors was higher than the correlation between each factor and its corresponding indicators. Furthermore, the discriminant validity is so far limited to just two

indicators (i.e., ecological behaviour and economic liberalism), and these indicators seem to present some construct overlap with the two higher-order factors, as indicated by the salient correlation between Preservation and ecological behaviour. Therefore, future research will need to assess the robustness and generality of this two dimensional higher-order structure of EA by conducting more extensive tests of discriminant validity, and by assessing the correlation between these two higher-order factors across different samples.

Moreover, there are at least two limitations of this research that deserve discussion. First, the sample from this study, as well as that from Milfont and Duckitt (2004), consisted only of psychology undergraduate students from New Zealand. Second, the findings are based on correlational designs. Future studies should use experimental or quasi-experimental designs to assess the discriminant validity of the two second-order factors. Milfont and Duckitt (2005) have attempted to overcome the first limitation by presenting evidence of the proposed structure of EA in different samples. They conducted two web studies, one in Brazil and another worldwide, and found that the correlated two-factor second-order structure had the best fit in both samples. However, the findings must be replicated in other countries, with different samples, and using different research designs.

In conclusion, our research program has been trying to contribute to the understanding of the dimensionality of EA. We believe that the Preservation and Utilization dimensions may be important theoretical and empirical tools to comprehend the cognitive structure of people's attitudes toward the environment. Hopefully, these two dimensions will also be important tools to change our current environmental problems, or, at least, be important tools to a better understanding of people-environment relations.

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Appendix
Environmental Attitude Inventory (EAI, Milfont & Duckitt, 2005)
Scale 01. Enjoyment of Nature

01. I am NOT the kind of person who loves spending time in wild, untamed wilderness areas.(R)
02. I really like going on trips into the countryside, for example to forests or fields.*
03. I find it very boring being out in wilderness areas.(R)*
04. Sometimes when I am unhappy, I find comfort in nature.
05. Being out in nature is a great stress reducer for me.*
06. I would rather spend my weekend in the city than in wilderness areas.(R)
07. I enjoy spending time in natural settings just for the sake of being out in nature.
08. I have a sense of well-being in the silence of nature.*
09. I find it more interesting in a shopping mall than out in the forest looking at trees and birds.(R)*
10. I think spending time in nature is boring.(R)*

Scale 02. Support for Interventionist Conservation Policies

01. Industry should be required to use recycled materials even when this costs more than making the same products from new raw materials.
02. Governments should control the rate at which raw materials are used to ensure that they last as long as possible.*
03. Controls should be placed on industry to protect the environment from pollution, even if it means things will cost more.*
04. People in developed societies are going to have to adopt a more conserving life-style in the future.*
05. The government should give generous financial support to research related to the development of alternative energy sources, such as solar energy.
06. I don't think people in developed societies are going to have to adopt a more conserving life-style in the future.(R)*
07. Industries should be able to use raw materials rather than recycled ones if this leads to lower prices and costs, even if it means the raw materials will eventually be used up.(R)*
08. It is wrong for governments to try and compel business and industry to put conservation before producing goods in the most efficient and cost effective manner.(R)
09. I am completely opposed to measures that would force industry to use recycled materials if this would make products more expensive.(R)
10. I am opposed to governments controlling and regulating the way raw materials are

used in order to try and make them last longer.(R)*

Scale 03. Environmental Movement Activism

01. If I ever get extra income I will donate some money to an environmental organisation.
02. I would like to join and actively participate in an environmentalist group.*
03. I don't think I would help to raise funds for environmental protection.(R)*
04. I would NOT get involved in an environmentalist organization.(R)*
05. Environmental protection costs a lot of money. I am prepared to help out in a fund-raising effort.*
06. I would not want to donate money to support an environmentalist cause.(R)*
07. I would NOT go out of my way to help recycling campaigns.(R)
08. I often try to persuade others that the environment is important.
09. I would like to support an environmental organization.*
10. I would never try to persuade others that environmental protection is important.(R)

Scale 04. Conservation Motivated by Anthropocentric Concern

01. One of the best things about recycling is that it saves money.
02. The worst thing about the loss of the rain forest is that it will restrict the development of new medicines.
03. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports.*
04. Nature is important because of what it can contribute to the pleasure and welfare of humans.*
05. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations.*
06. We should protect the environment for the well being of plants and animals rather then for the welfare of humans.(R)
07. Human happiness and human reproduction are less important than a healthy planet.(R)
08. Conservation is important even if it lowers peoples' standard of living.(R)*
09. We need to keep rivers and lakes clean in order to protect the environment, and NOT as places for people to enjoy water sports.(R)*
10. We should protect the environment even if it means peoples' welfare will suffer.(R)*

Scale 05. Confidence in Science and Technology

01. Most environmental problems can be solved by applying more and better technology.
02. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources.*
03. Science and technology do as much environmental harm as good.(R)
04. Modern science will NOT be able to solve our environmental problems.(R)*
05. We cannot keep counting on science and technology to solve our environmental problems.(R)*
06. Humans will eventually learn how to solve all environmental problems.*
07. The belief that advances in science and technology can solve our environmental problems is completely wrong and misguided.(R)*

08.   Humans will eventually learn enough about how nature works to be able to control it.
09.   Science and technology cannot solve the grave threats to our environment.(R)
10.   Modern science will solve our environmental problems.*

Scale 06. Environmental Threat

01.   If things continue on their present course, we will soon experience a major ecological catastrophe.*
02.   The earth is like a spaceship with very limited room and resources.
03.   The balance of nature is very delicate and easily upset.
04.   When humans interfere with nature it often produces disastrous consequences.*
05.   Humans are severely abusing the environment.*
06.   The idea that we will experience a major ecological catastrophe if things continue on their present course is misguided nonsense.(R)
07.   I cannot see any real environmental problems being created by rapid economic growth. It only creates benefits.(R)
08.   The idea that the balance of nature is terribly delicate and easily upset is much too pessimistic.(R)*
09.   I do not believe that the environment has been severely abused by humans.(R)*
10.   People who say that the unrelenting exploitation of nature has driven us to the brink of ecological collapse are wrong.(R)*

Scale 07. Altering Nature

01.   Grass and weeds growing between paving stones may be untidy but are natural and should be left alone.(R)
02.   The idea that natural areas should be maintained exactly as they are is silly, wasteful, and wrong.
03.   I'd prefer a garden that is wild and natural to a well groomed and ordered one.(R)*
04.   Human beings should not tamper with nature even when nature is uncomfortable and inconvenient for us.(R)*
05.   Turning new unused land over to cultivation and agricultural development should be stopped.(R)*
06.   I'd much prefer a garden that is well groomed and ordered to a wild and natural one.*
07.   When nature is uncomfortable and inconvenient for humans we have every right to change and remake it to suit ourselves.*
08.   Turning new unused land over to cultivation and agricultural development is positive and should be supported.
09.   Grass and weeds growing between pavement stones really looks untidy.*
10.   I oppose any removal of wilderness areas no matter how economically beneficial their development may be.(R)

Scale 08. Personal Conservation Behaviour

01.   I could not be bothered to save water or other natural resources.(R)*
02.   I make sure that during the winter the heating system in my room is not switched on too high.
03.   In my daily life I'm just not interested in trying to conserve water and/or power.(R)*
04.   Whenever possible, I take a short shower in order to conserve water.

05.   I always switch the light off when I don't need it on any more.*
06.   I drive whenever it suits me, even if it does pollute the atmosphere.(R)
07.   In my daily life I try to find ways to conserve water or power.*
08.   I am NOT the kind of person who makes efforts to conserve natural resources.(R)*
09.   Whenever possible, I try to save natural resources.*
10.   Even if public transportation was more efficient than it is, I would prefer to drive my car.(R)

Scale 09. Human Dominance Over Nature

01.   Humans were meant to rule over the rest of nature.*
02.   Human beings were created or evolved to dominate the rest of nature.*
03.   Plants and animals have as much right as humans to exist.(R)*
04.   Plants and animals exist primarily to be used by humans.*
05.   Humans are as much a part of the ecosystem as other animals.(R)
06.   Humans are no more important in nature than other living things.(R)
07.   Nature exists primarily for human use.
08.   Nature in all its forms and manifestations should be controlled by humans.
09.   I DO NOT believe humans were created or evolved to dominate the rest of nature.(R)*
10.   Humans are no more important than any other species.(R)*

Scale 10. Human Utilization of Nature

01.   It is all right for humans to use nature as a resource for economic purposes.
02.   Protecting peoples' jobs is more important than protecting the environment.*
03.   Humans do NOT have the right to damage the environment just to get greater economic growth.(R)*
04.   People have been giving far too little attention to how human progress has been damaging the environment.(R)
05.   Protecting the environment is more important than protecting economic growth.(R)*
06.   We should no longer use nature as a resource for economic purposes.(R)
07.   Protecting the environment is more important than protecting peoples' jobs.(R)*
08.   In order to protect the environment, we need economic growth.
09.   The question of the environment is secondary to economic growth.*
10.   The benefits of modern consumer products are more important than the pollution that results from their production and use.*

Scale 11. Ecocentric Concern

01.   The idea that nature is valuable for its own sake is naïve and wrong.(R)*
02.   It makes me sad to see natural environments destroyed.
03.   Nature is valuable for its own sake.*
04.   One of the worst things about overpopulation is that many natural areas are getting destroyed.
05.   I do not believe protecting the environment is an important issue.(R)*
06.   Despite our special abilities humans are still subject to the laws of nature.*
07.   It makes me sad to see forests cleared for agriculture.*
08.   It does NOT make me sad to see natural environments destroyed.(R)*

09.   I do not believe nature is valuable for its own sake.(R)

10.   I don't get upset at the idea of forests being cleared for agriculture. (R)

Scale 12. Support for Population Growth Policies

01.   We should strive for the goal of "zero population growth".

02.   The idea that we should control the population growth is wrong.(R)

03.   Families should be encouraged to limit themselves to two children or less.*

04.   A married couple should have as many children as they wish, as long as they can adequately provide for them. (R)*

05.   Our government should educate people concerning the importance of having two children or less.*

06.   We should never put limits on the number of children a couple can have.(R)*

07.   People who say overpopulation is a problem are completely incorrect.(R)

08.   The world would be better off if the population stopped growing.

09.   We would be better off if we dramatically reduced the number of people on the Earth.*

10.   The government has no right to require married couples to limit the number of children they can have.(R)*

Note. R = reversed coded items. * The six balanced items selected for a short version of the EAI.