

The Higher Order Structure of Environmental Attitudes: A Cross-Cultural Examination

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Abstract

Past research has suggested that Preservation and Utilization are the two higher order dimensions forming the hierarchical structure of environmental attitudes. This means that these two higher order dimensions could group all kinds of perceptions or beliefs regarding the natural environment people have. A cross-cultural study was conducted in Brazil, New Zealand, and South Africa to test this hierarchical structure of environmental attitudes. Results from single- and multi-group confirmatory factor analyses demonstrated that environmental attitudes are a multidimensional construct, and that their first-order factors associate to each other to form a vertical structure. However, the question whether the vertical structure comprise a single higher order factor or two higher order factors still remains unanswered. These results are discussed and directions for future research trying to demonstrate that Preservation and Utilization, taken as distinct second-order environmental attitudes factors, are more empirically meaningful than a single and generalised environmental attitudes higher order factor are presented.

Keywords: Environmental attitudes; Structure; Dimensionality; Hierarchy; Cross-cultural research.

A Estrutura Fatorial de Segunda Ordem das Atitudes Ambientais: Uma Investigação Transcultural

Resumo

Pesquisas anteriores têm indicado que Preservação e Utilização são as duas dimensões de segunda ordem que formam a estrutura hierárquica das atitudes ambientais. Isso significa que essas duas dimensões agrupam todos os tipos de percepções ou crenças que as pessoas têm sobre o meio-ambiente natural. Um estudo transcultural foi realizado no Brasil, Nova Zelândia e África do Sul para testar essa estrutura hierárquica das atitudes ambientais. Os resultados de análises fatoriais confirmatórias simples e multigrupais demonstraram que as atitudes ambientais formam um construto multidimensional e que seus fatores de primeira ordem associam-se entre si para formar uma estrutura vertical. No entanto, a questão se essa estrutura vertical compreende um único fator ou dois fatores de segunda ordem ainda permanece sem resposta. Esses resultados são discutidos e direções são apresentadas para pesquisas futuras tentando demonstrar que Preservação e Utilização, tomados como dois distintos fatores de segunda ordem, são empiricamente mais significativos do que um único fator de segunda ordem das atitudes ambientais.

Palavras-chave: Atitudes ambientais; Estrutura fatorial; Dimensionalidade; Hierarquia; Pesquisa transcultural.

Environmental attitudes are a crucial construct in environmental psychology, with more than half of all publications in the field dealing with it.² However,

research on environmental attitudes has previously been criticised as being noncumulative and atheoretical (Dietz, Stern, & Guagnano, 1998; Heberlein, 1981;

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² Updating Kaiser, Wölfling and Fuhler's (1999) literature review, a search in the PsychINFO database from 1967 to 2006 yielded 4001 publications dealing with environmental problems (Milfont, 2007b). The psychological index terms used were: environmental attitudes ($n = 2276$), conservation (ecological behaviour) ($n = 921$), pollution ($n = 488$), and

Stern, 1992). One way for addressing these issues and to bring greater clarity to the literature in the field is through a better understanding of the cognitive structure of environmental attitudes; that is, what kinds of perceptions or beliefs regarding the natural environment people have. The determination of this structure seems to be an important first step in fostering a psychology of environmental attitudes that might help to reduce environmental problems. Research has shown that comprehending the attitude structure helps in understanding the way people maintain consistency among their attitudes, and thus provides insights for persuasion and attitude change (Heberlein, 1981; McGuire, 1960, 1981).

Theoretical Background

Environmental attitudes are a psychological tendency that is expressed by evaluating the natural environment with some degree of favour or disfavour (Milfont, 2007b). It has been claimed that the cognitive structure of environmental attitudes, or the issue of their dimensionality, has not yet been resolved (Dunlap & Jones, 2002). However, some important approaches to the structure of environmental attitudes have been proposed. These approaches can be grouped into studies examining the horizontal structure of environmental attitudes and those examining their vertical structure (Milfont, 2007a). In psychometric terms, the horizontal structure refers to the primary order or first-order factor(s) forming the structure of environmental attitudes, while the vertical structure refers to the higher order or second-order factor(s).

The horizontal structure of environmental attitudes refers to their dimensionality. Hence, the issue here is whether environmental attitudes are inherently multidimensional or whether it is legitimate to treat them as a unidimensional construct (Dunlap & Jones, 2002). Studies examining the horizontal structure see environmental attitudes as either a multidimensional construct related to value-based orientations (e.g., Schultz, 2001; Thompson & Barton, 1994) or as a unidimensional, bipolar construct (e.g., Dunlap, Van Liere, Mertig, & Jones, 2000; Pierce & Lovrich, 1980). Despite the fact that several researchers still consider environmental attitudes as a unidimensional construct in their studies, there seem to be a consensus in the literature that environmental attitudes are a multidimensional construct

(Dunlap & Jones, 2002; Heberlein, 1981). Hence, the horizontal structure of environmental attitudes comprises a number of dimensions.

Studies examining the vertical structure are more relevant in the present context and will be reviewed in more detail. The vertical structure of environmental attitudes refers to their hierarchical nature. In other words, it refers to the higher order or second-order factor(s) forming the hierarchical structure of environmental attitudes. Studies examining this hierarchical structure have either proposed a single higher order factor or two higher order factors.

A Single Higher Order Factor for the Vertical Structure of Environmental Attitudes

To date, only two empirical studies have directly tested whether the hierarchical structure of environmental attitudes comprises a single higher order factor (Carman, 1998; Xiao & Dunlap, 2007). Carman (1998) used data from the 1995 American National Election Study Pilot to test a higher order model of environmental policy support. In this model, the second-order factor was derived from three first-order factors: environmental economic concern (4 items), environmental regulation concern (5 items), and environmental quality assessment (4 items). The model had good fit to the data and the three first-order factors were good indicators of the second-order factor, suggesting therefore a unidimensional higher order structure for environmental policy support. Although Carman's (1998) work is a pioneering contribution for the study of the vertical structure of environmental attitudes, he focused only on environmental policy support.

Xiao and Dunlap (2007) expanded Carman's (1998) findings by including a broader range of facets. They used data from national probability samples of citizens from the US and Canada to test a higher order model of environmental concern. The second-order environmental concern factor was derived from eight first-order factors: perceived importance of environmental problems (3 items), willingness to pay for environmental protection (4 items), support for governmental policies and regulations (5 items), pro-environmental behaviours and activism (3 items), global environmental issues (7 items), national environmental issues (7 items), community environmental issues (7 items), and the New Environmental Paradigm (NEP) scale (8 items). Although the factor loadings of community and national environmental issues were relatively weak, all other first-order factors were good indicators of the higher order environmental concern factor and the model had good fit to the data in both countries.

In summary, both Carman's (1998) and Xiao and Dunlap's (2007) findings suggest that a single higher order factor is likely for the hierarchical, vertical

environmental education ($n = 316$). Given the multiple use of index terms, the total number of publications is reduced to $n = 3326$. Of these, the majority (50.2%) refer to environmental attitudes. Note that this represents a reduction in the proportion of studies dealing with this construct because Kaiser et al. found that the majority (62.2%) of the publications from 1967 to 1995 refer to environmental attitudes. Nevertheless, it highlights the importance of this construct to the field.

structure of environmental attitudes. There is also some support in the literature that a single higher order dimension underlies the evaluating perceptions of or beliefs regarding the natural environment (e.g., Guber, 1996; Pierce & Lovrich, 1980). However, other research has suggested that a structure with two higher order factors is a better model to account for the hierarchical nature of environmental attitudes.

Two Higher Order Factors for the Vertical Structure of Environmental Attitudes

Bogner and his associates (e.g., Bogner, Brenngelmann, & Wiseman, 2000; Bogner & Wiseman, 1997, 1999) have shown that two higher order factors underlie the perceptions and beliefs related to the natural environment. Investigating the second-order factor structure of environmental attitudes, Bogner and Wiseman (2002) factor analysed five first-order factors obtained in their original study (i.e., Bogner & Wiseman, 1999) together with the three first-order factors from the NEP scale (Dunlap & Van Liere, 1978). Two factors emerged. The first factor was labelled Preservation and was formed by four first-order factors: intent of support, enjoyment of nature, limits of growth, and care with resources. The second factor was labelled Utilization and was formed by the other four first-order factors: human over nature, altering nature, human dominance, and balance of nature. These two higher order factors were negatively correlated with each other ($r = -.26$).

Wiseman and Bogner (2003) used these findings to propose a two-dimensional Model of Ecological Values to account for the higher order structure of environmental attitudes. They described their model as follows: "Ecological Values are determined 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). According to this model, Preservation and Utilization are the two high order factors that explain the hierarchical nature of environmental attitudes. These factors reflect a dilemma confronting people: how to balance the conservation of the natural environment with the need for some forms of exploitation of the environment.

While proposing an important new approach to the vertical structure of environmental attitudes, the work of Bogner and associates are open to certain criticisms (Milfont & Duckitt, 2004): (a) They reported a significant correlations between their two higher order factors (Bogner & Wiseman, 2002, p. 229; Wiseman & Bogner, 2003, p. 789), but they presented their model as composed of two orthogonal dimensions, with this orthogonality treated as theoretically desirable (Wiseman

& Bogner, 2003, p. 787); (b) their scale contains five unbalanced environmental attitudes subscales, and may therefore be open to acquiescence bias, so that direction-of-wording effects might be responsible for the relative independence between their two factors; (c) the eight first-order factors included in their analyses to obtain second-order factors do not seem to cover the full range of possible first-order environmental attitudes factors; and (d) Bogner and his colleagues used only exploratory factor analysis to investigate the environmental attitudes second-order structure.

To overcome these problems, we have developed a program of research to investigate the multidimensionality and higher order structure of environmental attitudes (Milfont, 2007b; Milfont & Duckitt, 2004, 2006). In one study, we evaluated the structure of environmental attitudes by factor analysing 99 items from well-know measures (Milfont & Duckitt, 2004). The results from both exploratory and confirmatory factor analysis showed that the environmental attitudes were organized in a hierarchical structure. These were ten first-order factors that loaded on one of two correlated second-order factors. These findings indicated that Preservation and Utilization were strongly correlated and not orthogonal, as proposed by Bogner and colleagues. A new measure was introduced in a second study to systematically assess the vertical structure of environmental attitudes (Milfont & Duckitt, 2006). Once again the twelve first-order factors loaded on two correlated second-order factors, labelled Preservation and Utilization.

Overall our research has indicated that environmental attitudes are a multidimensional construct and organized in a hierarchical fashion. More importantly, we have found that: (a) a two-dimensional higher order structure tend to fit the data better than a structure with a single higher order factor; (b) the factors of a two-dimensional higher order structure corresponded to Preservation and Utilization dimensions of environmental attitudes; (c) discriminant validity for these two higher order dimensions was demonstrated by showing that self-reported ecological behaviour was predicted by Preservation, and not by Utilization, while attitudes toward economic liberalism were predicted by Utilization, and not by Preservation, and (d) this two-dimensional higher order model of environmental attitudes has also theoretical support (Milfont, 2007b).

The Present Study

Research has suggested that Preservation and Utilization are the two higher order dimensions forming the vertical structure of environmental attitudes. However, our previous published studies examining the structure of environmental attitudes, and specifically the

distinction between Preservation and Utilization, have been based only on data from New Zealand (Milfont & Duckitt, 2004, 2006). The present paper overcomes this limitation by reporting findings from a cross-cultural study conducted in Brazil, New Zealand, and South Africa. This cross-cultural study had three main objectives: (a) to provide further evidence of the psychometric properties of the short-form of the Environmental Attitudes Inventory (described below), (b) to test whether the vertical structure of environmental attitudes comprises a single higher order factor or two higher order factors, and (c) to test whether these two hierarchical models are invariant across cultures.

Method

Participants

A questionnaire-based study was conducted in 2005 with undergraduate psychology students from Brazil, New Zealand, and South Africa. The Brazil sample was composed of 201 students (149 females, 52 males) with ages ranging from 18 to 47 years ($M = 22.17$, $SD = 4.27$), the New Zealand sample was composed of 226 students (159 females, 67 males) with ages ranging from 17 to 39 years ($M = 19.48$, $SD = 2.54$), and the South

Africa sample was composed of 257 students (187 females, 71 males) with ages ranging from 17 to 42 years ($M = 19.36$, $SD = 2.69$). The countries and participants were a convenience sample.

Instruments

The questionnaire consisted of several parts (see Milfont, 2007b, Study 3), but only one measure is relevant in the present study. The Environmental Attitudes Inventory (EAI) is a culture-general and fully-balanced tool developed to measure the multidimensional and hierarchical structure of environmental attitudes (Milfont & Duckitt, 2010). This inventory captures both the vertical and horizontal structure of environmental attitudes by measuring twelve specific facets, or first-order factors, that define the two-dimensional higher order structure of environmental attitudes (i.e., Preservation and Utilization). For this cross-cultural study a short-form version of this measure was used. The short-form version of the Environmental Attitudes Inventory (EAI-S) consists of 72 items, with three positively worded and three negatively worded items for each of the 12 scales. Table 1 provides an overview of the scales, and a detailed description of the EAI can be found elsewhere (Milfont & Duckitt, 2006, 2010).

Table 1
Scales of the Environmental Attitudes Inventory, their Construct Definition and Example of Items

Scale Label	Construct Definition	Example of Items
Scale 01. <i>Enjoyment of Nature</i>	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.	I really like going on trips into the countryside, for example to forests or fields. I think spending time in nature is boring. (R)
Scale 02. <i>Support for Interventionist Conservation Policies</i>	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.	Controls should be placed on industry to protect the environment from pollution, even if it means things will cost more. 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)
Scale 03. <i>Environmental Movement Activism</i>	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.	I would like to join and actively participate in an environmentalist group. I would NOT go out of my way to help recycling campaigns. (R)
Scale 04. <i>Conservation Motivated by Anthropocentric Concern</i>	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.	Nature is important because of what it can contribute to the pleasure and welfare of humans. We should protect the environment even if it means peoples' welfare will suffer. (R)

Scale 05. <i>Confidence in Science and Technology</i>	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.	Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources. We cannot keep counting on science and technology to solve our environmental problems. (R)
Scale 06. <i>Environmental Threat</i>	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.	Humans are severely abusing the environment. The idea that the balance of nature is terribly delicate and easily upset is much too pessimistic. (R)
Scale 07. <i>Altering Nature</i>	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.	When nature is uncomfortable and inconvenient for humans we have every right to change and remake it to suit ourselves. Turning new unused land over to cultivation and agricultural development should be stopped. (R)
Scale 08. <i>Personal Conservation Behaviour</i>	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.	In my daily life I try to find ways to conserve water or power. In my daily life I'm just not interested in trying to conserve water and/or power. (R)
Scale 09. <i>Human Dominance Over Nature</i>	Belief that nature exists primarily for human use, versus beliefs that humans and nature has the same rights.	Humans were meant to rule over the rest of nature. Plants and animals have as much right as humans to exist. (R)
Scale 10. <i>Human Utilization of Nature</i>	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.	The question of the environment is secondary to economic growth. We should no longer use nature as a resource for economic purposes. (R)
Scale 11. <i>Ecocentric Concern</i>	A nostalgic concern and sense of emotional loss over environmental damage and loss, versus absence of any concern or regret over environmental damage.	Nature is valuable for its own sake. The idea that nature is valuable for its own sake is naïve and wrong. (R)
Scale 12. <i>Support for Population Growth Policies</i>	Support for policies regulating the population growth and concern about overpopulation, versus lack of any support to such policies and concern.	Families should be encouraged to limit themselves to two children or less. We should never put limits on the number of children a couple can have. (R)

Note. R = reversed coded items.

Procedure and Data Analyses

The questionnaire was administered to students in classrooms by the authors or trained research staff. Students were assured that their responses were totally confidential, and no course credit or any other incenti-

ve was offered for their participation. The questionnaire was translated into Brazilian-Portuguese and Afrikaans using a bilingual committee approach (van de Vijver & Leung, 1997). The South African participants were able to choose between an English or Afrikaans version of

the questionnaire. Most of the participants (57.2%, $n = 147$) chose the English version.

The reliability of the scales was examined in relation to the instrument's internal consistency (Cronbach's alpha coefficients) and homogeneity (mean inter-item correlations) (Briggs & Cheek, 1986). The environmental attitudes structure was tested using single-group and multi-group confirmatory factor analyses. These analyses were performed using LISREL and maximum-likelihood estimation procedures, taking the observed covariance matrix as the input. The degree to which the data fit the models were assessed using the ratio of the chi-square statistic to the degrees of freedom (χ^2/df), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Models with a χ^2/df ratio in the range of 2–3, and CFI, RMSEA and SRMR with values respectively close to .95, .06 and .08 or better indicate acceptable fit (Carmines & McIver, 1981; Hu & Bentler, 1999). Furthermore, the difference in chi-square between two nested models, the expected cross-validation index (ECVI), the consis-

tent Akaike information criterion (CAIC), and the target coefficient (T) were used as incremental fit indices to calculate improvements over competing models. Significant results for the χ^2 difference test reflect that the model with smaller χ^2 has a better fit, and lower ECVI and CAIC values and higher T values reflect the model with the better fit (Garson, 2003; Marsh & Hocevar, 1985).

Results

Descriptive Statistics and Reliabilities

Table 2 shows the alpha coefficients, mean inter-item correlations, skewness and kurtosis for the twelve EAI-S scales. In general the internal reliabilities were lower in Brazil and in South Africa than in New Zealand. Van de Vijver and Leung's (1997, Box 4.1) procedure was used to test equality of internal reliabilities, with New Zealand as the baseline sample. All but five scales (Scales 3, 4, 6, 9, and 11) had a significantly lower reliability in Brazil, and all but five scales (Scales 3, 4, 6, 7, and 11) had a significantly lower reliability in South

Table 2
Descriptive Scale Statistics for the EAI-S in Brazil, New Zealand and South Africa

Scale	Brazil				New Zealand				South Africa			
	α	M_r	Skewness	Kurtosis	α	M_r	Skewness	Kurtosis	α	M_r	Skewness	Kurtosis
1. Enjoyment of nature	.82	.44	-.58	-.52	.88	.55	-.67	.19	.81	.43	-.97	1.10
2. Conservation policies	.60	.21	-.66	-.22	.83	.45	-.48	-.07	.68	.27	-.80	1.69
3. Environmental activism	.85	.48	-.14	-.52	.87	.54	-.47	.31	.86	.50	-.34	.02
4. Anthropocentric concern	.44	.11	-.30	.32	.53	.16	-.01	-.13	.55	.16	.03	-.01
5. Confidence in Science	.77	.36	-.28	.02	.82	.44	.29	.77	.77	.36	-.01	.21
6. Environmental fragility	.75	.35	-.67	.33	.76	.34	.17	-.12	.71	.30	-.31	-.21
7. Altering nature	.58	.18	.19	.12	.67	.25	-.30	.54	.71	.28	-.22	.07
8. Personal conservation	.73	.33	-.58	.13	.84	.46	-.65	.76	.77	.35	-.86	1.35
9. Dominance over nature	.83	.44	.49	-.35	.86	.51	.48	-.20	.78	.37	.15	-.31
10. Utilization of nature	.67	.25	-.25	-.07	.78	.37	.12	.99	.67	.25	-.25	.17
11. Ecocentric concern	.66	.26	-.46	-.02	.71	.29	-.29	.20	.67	.26	-.35	-.32
12. Population growth	.83	.44	.12	-.25	.88	.54	.42	.03	.83	.45	-.05	-.22

Note. Brazil: $N = 201$. New Zealand: $N = 226$. South Africa: $N = 257$. M_r = mean inter-item correlation. All scales have 6 items.

Africa. The only problematic scales were Scales 4 and 7, especially in Brazil and South Africa. The low reliabilities of these scales may be due to the constructs they aim to measure. Thompson and Barton (1994) also found a low internal reliability ($\alpha = .58$ in Study 1, and $\alpha = .67$, in Study 2) for their anthropocentric attitude scale. Using this scale, Schultz and Zelezny (1999) also reported a strong variability of the alpha reliabilities across 14 countries, ranging from .64 to .81. Thus, the low internal consistency of the Scale 4 may be due to the general aspect of the construct it aims to measure rather than a weakness of the scale per se. This may also be the case for Scale 7. Overall, however, most EAI-S scales showed satisfactory internal reliabilities and homogeneity, with alphas higher than .60 and mean inter-item correlations higher than .15. Moreover, none of the scales showed serious deviation from normality.

Testing the EAI-S Structural Model

A confirmatory approach was taken to systematically test alternative higher order models. Three item parcels were created for each of the twelve EAI-S scales using the

single factor method (Landis, Beal, & Tesluk, 2000), with a pro- and a con-trait item comprising each parcel. The same set of items forming the item parcels were used across samples, and three models were tested for each sample.

Model 1 was a one-second-order-factor model in which the twelve first-order factors are associated with each other and their correlations are jointly explained by a single second-order factor. This model thus supports the generality of environmental attitudes and the view that the vertical structure of environmental attitudes constitute a single higher order dimension (cf. Carman, 1998; Xiao & Dunlap, 2007). The single higher order dimension consists of twelve tightly covarying domains. This means that individuals who support environmental attitudes in a specific domain will tend to support environmental attitudes in other domains, and certain individuals will tend to be more favourable to such domains in general. The single broad higher order dimension organizing environmental attitudes was labelled "Generalized Environmental Attitudes" (GEA). This model is depicted in Figure 1. To simplify, manifest variables and the paths from latent to manifest variables are not shown.

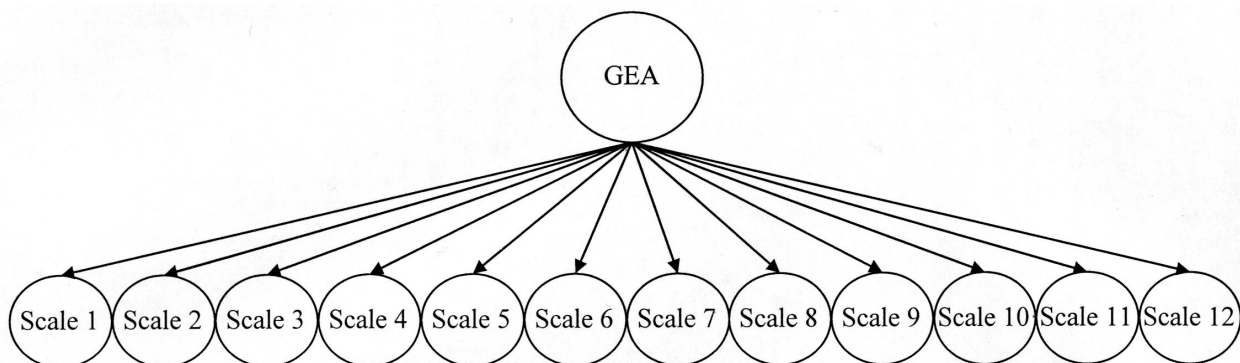


Figure 1. Higher order structure for Model 1. Note. GEA = Generalized Environmental Attitudes.

Model 2 was a two-uncorrelated-second-order-factors model in which seven first-order factors (i.e., Scales 1, 2, 3, 6, 8, 11, and 12) are associated with each other and their correlations are jointly explained by one second-order factor (i.e., Preservation), and the remaining five first-order factors (i.e., Scales 4, 5, 7, 9, and 10) are associated with each other and their correlations are jointly explained by another second-order factor (i.e., Utilization). Additionally, the two second-order factors are uncorrelated (see Figure 2). Model 3 was a two-correlated-second-order-factors model, and differs from Model 2 because the two second-order factors are allowed to correlate (see Figure 3). This final model thus supports the view that the vertical structure of environmental attitudes constitutes two higher order factors (cf. Milfont & Duckitt, 2004).

Each model was fitted to the data from each country separately. The results are reported in Table 3. As can be seen, Models 1 and 3 had better overall fit indices than Model 2. The two-correlated-second-order-factors model was statistically better fitting than the one-second-order-factor model in Brazil, $\chi^2(1) = 12.76$, $p < .001$, and marginally better fitting in South Africa, $\chi^2(1) = 3.04$, $p < .10$. There was no significant difference between these two models in the New Zealand sample, $\chi^2(1) = 0.14$, $p > .05$. The correlations between the Preservation and Utilization latent factors were extremely high in all three countries: Brazil ($\Phi = -.86$), New Zealand ($\Phi = -.96$), and South Africa ($\Phi = -.91$). These results show similar fit indices for the theoretically alternative higher order models (Models 1 and 3), and extremely high correlations between Preservation and Utilization across countries.

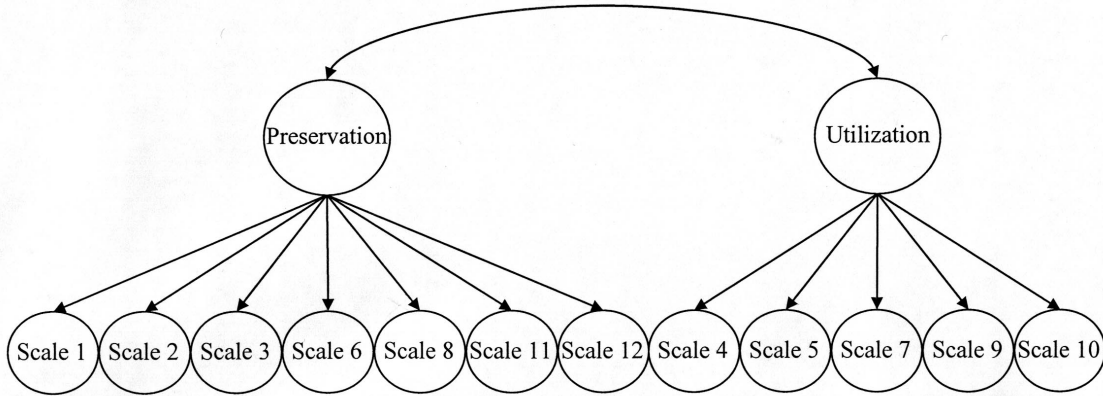


Figure 2. Higher order structure for Model 2

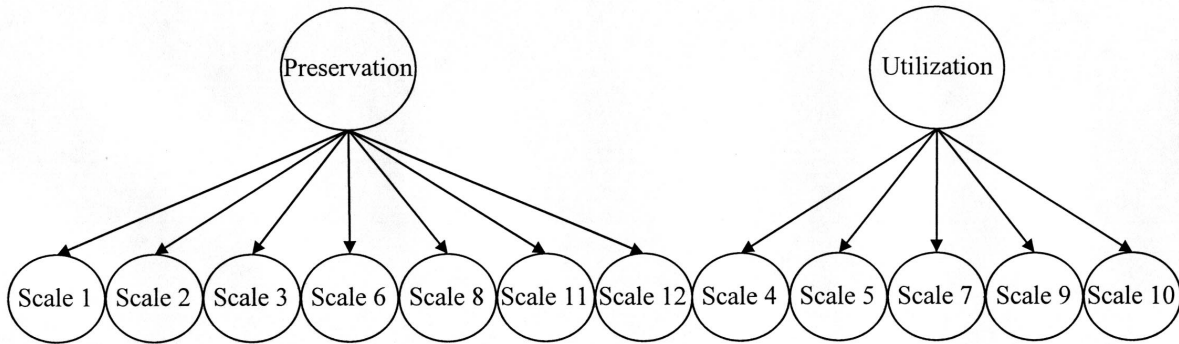


Figure 3. Higher order structure for Model 3

Table 3
Fit Indices for Alternative Models Across Countries

Models	χ^2	df	χ^2/df	RMSEA	RMSEA (90%CI)	SRMR	CFI	ECVI	ECVI (90%CI)	CAIC	T
Model 1											
Brazil	839.78	582	1.44	.047	(.040-.054)	.076	.95	5.04	(4.67-5.44)	1369.26	.779
New Zealand	1056.51	582	1.82	.060	(.054-.066)	.076	.95	5.44	(5.05-5.86)	1595.83	.798
South Africa	922.99	582	1.59	.048	(.042-.054)	.075	.95	4.26	(3.95-4.60)	1473.11	.824
Model 2											
Brazil	873.68	582	1.50	.050	(.043-.057)	.14	.94	5.21	(4.83-5.63)	1403.15	.749
New Zealand	1168.70	582	2.00	.067	(.061-.072)	.17	.94	5.94	(5.52-6.39)	1708.02	.722
South Africa	1034.90	582	1.78	.055	(.050-.061)	.13	.93	4.70	(4.36-5.06)	1585.02	.735
Model 3											
Brazil	827.02	581	1.42	.046	(.039-.053)	.075	.95	4.99	(4.62-5.39)	1362.80	.791
New Zealand	1056.37	581	1.82	.060	(.054-.066)	.076	.95	5.45	(5.06-5.87)	1602.12	.798
South Africa	919.95	581	1.58	.048	(.042-.053)	.075	.95	4.26	(3.95-4.60)	1476.62	.827

Note. Brazil: $N = 201$. New Zealand: $N = 226$. South Africa: $N = 257$. Models: 1 = one-second-order-factor; 2 = two-uncorrelated-second-order-factors; 3 = two-correlated-second-order-factors. All χ^2 statistics are significant at $p < .001$. χ^2/df = the ratio of chi-square to degrees of freedom; RMSEA = root mean square error of approximation; 90%CI = 90 percent confidence interval; SRMR = standardized root mean square residual; CFI = comparative fit index; ECVI = expected cross-validation index; CAIC = consistent Akaike information criterion; T = target coefficient.

Testing the Measurement Invariance of the EAI-S

Multi-group confirmatory factor analyses were performed to test the measurement invariance of both the one-second-order-factor model and the two-

correlated-second-order-factors model across countries. Measurement invariance allows the researcher to check if members of different groups or cultures ascribe the same meanings to scale items or constructs investigated

(Cheung & Rensvold, 1999, 2000; Little, 2000; Milfont, Duckitt, & Cameron, 2006; Steenkamp & Baumgartner, 1998). Only configural invariance was tested here. Testing the configural invariance model (also known as the baseline model) is the first step to establish measurement invariance, and is satisfied if the basic model structure is invariant across groups, indicating that participants from different groups conceptualize the constructs in the same way. This model was tested by constraining the factorial structure to be equal across groups. Configural invariance for the one-second-order-factor model had good overall fit for the data: $\chi^2 = 2875.60$; $df = 1770$; $\chi^2/df = 1.62$; RMSEA = .052, 90%CI = .049-.056; CFI = .95. Configural invariance for the two-correlated-second-order-factors model also had good overall fit for the data: $\chi^2 = 2803.33$; $df = 1743$; $\chi^2/df = 1.61$; RMSEA = .052, 90%CI = .048-.055; CFI = .95. These results show that the assumption of configural invariance of these two environmental attitudes models across samples from Brazil, New Zealand and South Africa is upheld.

Discussion

This paper examined the structure of environmental attitudes cross-culturally and addressed three main issues. First, the study offered further evidence of the psychometric properties of the short-form version of the Environmental Attitudes Inventory ([EAI-S], Milfont & Duckitt, 2010). Overall, the EAI-S scales had reasonable internal consistency and homogeneity across samples from Brazil, New Zealand, and South Africa. Second, the configural invariance of the EAI-S was found to be adequate across these cultures. This suggests that participants from these countries conceptualize environmental attitudes and their components in the same way, and that the relations between the underlying constructs are similar across countries. Finally, and most importantly, the findings also offered further evidence for the hierarchical nature of environmental attitudes. The findings demonstrated that environmental attitudes are a multidimensional construct, and that their first-order factors associate to each other to form a vertical structure.

This cross-cultural study addressed many issues, but a key question still remains answered: Does the vertical structure of environmental attitudes comprise a single higher order factor or two higher order factors? The present results indicated that the two-correlated-second-order-factors model fitted the data slightly better. This suggests that the best conceptualization of the vertical structure of environmental attitudes is a model with two higher order factors, with Preservation and Utilization forming the second-order dimensions. This two-dimensional higher order model has some theoretical support.

First, this model is supported by Kaiser and Scheuthle's (2003) argument 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). The proposition that environmental attitudes seem to form two dimensions is also consistent with more general theories proposing that human-environment relations can be viewed in terms of two distinct beliefs (Barbieri, 1997; Berger, 1979; Dobson, 1998; Dunlap & Van Liere, 1978; Stokols, 1990; Thompson & Barton, 1994). In one hand, there is a set of beliefs that focus on preserving nature and the diversity of natural species in its original natural status, and protecting it from human use and alteration. On the other hand, there is another set of beliefs expressing that it is right, appropriate and necessary for nature and all natural phenomena and species to be used and altered for human objectives. These two sets of contrasting beliefs are closely related to Preservation and Utilization, respectively. These empirical and theoretical contributions thus seem to indicate that the vertical structure of environmental attitudes comprises Preservation and Utilization dimensions, which is in line with previous findings (Milfont & Duckitt, 2004, 2006; Wiseman & Bogner, 2003).

However, there are also empirical and theoretical evidence supporting a single higher order model (cf. Carman, 1998; Xiao & Dunlap, 2007). First, the fit indices for the one-second-order-factor and the two-correlated-second-order-factors models were very similar across countries (see Table 2). An extremely high correlation between Preservation and Utilization was also observed across countries (average $\Phi = -.91$). In view of the extremely high correlations between the latent factors and the virtually identical model fit between the models across countries, it can be concluded that the one-second-order-factor model is the most parsimonious explanation of the vertical structure of environmental attitudes. Theoretical propositions also argue for a unidimensional higher order model. Pierce and Lovrich (1980) claimed that beliefs about environmental issues "seem to fit together on a single dimension, thus suggesting some underlying general concept or fundamental orientation to which these beliefs are mutually connected" (p. 261). Similarly, Guber (1996) commented that "results suggest that not only can the standard environmental battery used by Gallup be reduced to relatively few latent factors, those factors are themselves strongly correlated across a diverse set of environmental issues" (p. 644).

Overall, the evidences gathered so far seems to indicate that the single higher order model is preferable on the grounds of the principle of parsimony. Preser-

vation and Utilization appear theoretically promising, but only additional research can clarify if the two higher order factors model does have significant empirical advantages over the more parsimonious one higher order factor model. Hence, to support the notion that people's environmental attitudes consists of two distinguishable lines of values (Kaiser & Fuhler, 2003; Milfont & Duckitt, 2004; Wiseman & Bogner, 2003), future research should demonstrate that Preservation and Utilization, taken as distinct second-order environmental attitudes factors, are more empirically meaningful than a single and generalised environmental attitudes higher order factor. Because empirical studies have so far relied on survey data (Milfont, 2009; Milfont & Duckitt, 2004, 2006; Wiseman & Bogner, 2003), future studies addressing the empirical distinction between Preservation and Utilization should employ experimental designs. Experimental research could use a functional approach to environmental attitudes (Milfont, 2009) to manipulate and/or prime Preservation and Utilization orientations. If these orientations are really distinct, individuals primed with Preservation orientations toward the natural environment would have their environmentally friendly behaviours enhanced (compared to a control group), while individuals primed with Utilization orientations would have such behaviours reduced. This line of research may generate important theoretical inputs in the field.

Another option for testing the possible distinction between Preservation and Utilization is to explore a recent theoretical development in the area proposed by Kaiser and colleagues (Kaiser, Byrka, & Hartig, 2008; Kaiser, Oerke, & Bogner, 2007). Kaiser has developed a paradigm for attitude research in which individual behaviour is a function of individual's attitude level and the behaviour-specific costs involved. In this paradigm, environmental attitudes represent acquired behavioural dispositions. If this holds, Preservation and Utilization should represent distinct acquired behavioural dispositions and could be more easily distinguished. This seems a very important development for the conceptual understanding of environmental attitudes, and should be considered in future research addressing their cognitive structure.

References

- Barbieri, J. C. (1997). *Desenvolvimento e meio ambiente: As estratégias de mudanças da Agenda 21* [Development and environment: The strategies of change from the Agenda 21]. Petropolis, RJ: Vozes.
- Berger, J. (1979). *Pig earth*. London: Writers and Readers.
- Bogner, F. X., Brengelmann, J. C., & Wiseman, M. (2000). Risk-taking and environmental perception. *The Environmentalist*, 20, 49-62.
- Bogner, F. X., & Wiseman, M. (1997). Environmental perception of rural and urban pupils. *Journal of Environmental Psychology*, 17, 111-122.
- Bogner, F. X., & Wiseman, M. (1999). Toward measuring adolescent environmental perception. *European Psychologist*, 4, 139-151.
- Bogner, F. X., & Wiseman, M. (2002). Environmental perception: Factor profiles of extreme groups. *European Psychologist*, 7, 225-237.
- Briggs, S. R., & Cheek, J. M. (1986). The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality*, 54, 106-148.
- Carman, C. J. (1998). Dimensions of environmental policy support in the United States. *Social Science Quarterly*, 79, 717-733.
- Carmines, E. G., & McIver, J. D. (1981). Analyzing models with unobserved variables: Analysis of covariance structures. In G. W. Bohinstdt & E. F. Borgatta (Eds.), *Social measurement: Current issues* (pp. 65-115). Beverly Hills, CA: Sage.
- Cheung, G. W., & Rensvold, R. B. (1999). Testing factorial invariance across groups: A reconceptualization and proposed new method. *Journal of Management*, 25, 1-27.
- Cheung, G. W., & Rensvold, R. B. (2000). Assessing extreme and acquiescence response sets in cross-cultural research using structural equations modeling. *Journal of Cross-Cultural Psychology*, 31, 188-213.
- Dietz, T., Stern, P. C., & Guagnano, G. A. (1998). Social structural and social psychological bases of environmental concern. *Environment and Behavior*, 30, 450-471.
- Dobson, A. (1998). *Justice and the environment: Conceptions of environmental sustainability and dimensions of social justice*. New York: Oxford University Press.
- Dunlap, R. E., & Jones, R. E. (2002). Environmental concern: Conceptual and measurement issues. In R. E. Dunlap & W. Michelson (Eds.), *Handbook of environmental sociology* (pp. 482-524). Westport, CT: Greenwood Press.
- Dunlap, R. E., & Van Liere, K. D. (1978). The new environmental paradigm. *Journal of Environmental Education*, 9, 10-19.
- Dunlap, R. E., Van Liere, K. D., Mertig, A., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, 56, 425-442.
- Garson, G. D. (2003). *PA 765 Statnotes: An online textbook*. Retrieved February 07, 2004, from <http://www2.chass.ncsu.edu/garson/pa765/statnote.htm>
- Guber, D. L. (1996). Environmental concern and the dimensionality problem: A new approach to an old predicament. *Social Science Quarterly*, 77, 644-662.
- Heberlein, T. A. (1981). Environmental attitudes. *Zeitschrift für Umweltpolitik*, 4, 241-270.
- Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.
- Kaiser, F. G., Byrka, K., & Hartig, T. (2008). *Attitudes as behavioural dispositions: Consolidation of Campbell's paradigm for attitude research*. Unpublished manuscript.
- Kaiser, F. G., & Fuhler, U. (2003). Ecological behaviour's dependency on different forms of knowledge. *Applied Psychology: An International Review*, 52, 598-613.
- Kaiser, F. G., Oerke, B., & Bogner, F. X. (2007). Behavior-based environmental attitude: Development of an instrument for adolescents. *Journal of Environmental Psychology*, 27, 242-251.
- Kaiser, F. G., & Scheuthle, H. (2003). Two challenges to a moral extension of the theory of planned behavior: Moral norms and just world beliefs in conservationism. *Personality and Individual Differences*, 35, 1033-1048.
- Kaiser, F. G., Wölfling, S., & Fuhler, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology*, 19, 1-19.
- Landis, R. S., Beal, D. J., & Tesluk, P. E. (2000). A comparison of approaches to forming composite measures in structural equation models. *Organizational Research Methods*, 3, 186-207.

- Little, T. D. (2000). On the comparability of constructs in cross-cultural research: A critique of Cheung and Rensvold. *Journal of Cross-Cultural Psychology, 31*, 213-219.
- Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First- and higher order factor models and their invariance across groups. *Psychological Bulletin, 97*, 562-582.
- McGuire, W. J. (1960). Cognitive consistency and attitude change. *Journal of Abnormal and Social Psychology, 60*, 345-353.
- McGuire, W. J. (1981). The probabilistic model of cognitive structure and attitude change. In R. E. Petty, T. M. Ostrom, & T. C. Brock (Eds.), *Cognitive responses in persuasion* (pp. 291-307). Hillsdale, NJ: Erlbaum.
- Milfont, T. L. (2007a, July). *Different approaches to the dimensionality of environmental concern*. Paper presented at the 31st Interamerican Congress of Psychology, Mexico, DF.
- Milfont, T. L. (2007b). *Psychology of environmental attitudes: A cross-cultural study of their content and structure*. Unpublished doctoral dissertation, University of Auckland, New Zealand.
- Milfont, T. L. (2009, June). *Environmental attitudes: The distinction between environmental preservation and environmental utilization*. Paper presented at the XXXII Interamerican Congress of Psychology, Guatemala City, Guatemala.
- Milfont, T. L. (2009). A functional approach to the study of environmental attitudes. *Medio Ambiente y Comportamiento Humano, 10*, 235-252.
- Milfont, T. L., & Duckitt, J. (2004). The structure of environmental attitudes: A first- and second-order confirmatory factor analysis. *Journal of Environmental Psychology, 24*, 289-303.
- Milfont, T. L., & Duckitt, J. (2006). Preservation and utilization: Understanding the structure of environmental attitudes. *Medio Ambiente y Comportamiento Humano, 7*, 29-50.
- Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology, 30*, 80-94.
- Milfont, T. L., Duckitt, J., & Cameron, L. D. (2006). A cross-cultural study of environmental motive concerns and their implications for proenvironmental behavior. *Environment and Behavior, 38*, 745-767.
- Pierce, J. C., & Lovrich, N. P., Jr. (1980). Belief systems concerning the environment: The general public, attentive publics, and state legislators. *Political Behavior, 2*, 259-286.
- Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*, 327-339.
- Schultz, P. W., & Zelezny, L. C. (1999). Values as predictors of environmental attitudes: Evidence for consistency across 14 countries. *Journal of Environmental Psychology, 19*, 255-265.
- Steenkamp, J.-B. E. M., & Baumgartner, H. (1998). Assessing measurement invariance in cross-national consumer research. *Journal of Consumer Research, 25*, 78-90.
- Stern, P. C. (1992). Psychological dimensions of global environmental change. *Annual Review of Psychology, 43*, 269-302.
- Stokols, D. (1990). Instrumental and spiritual views of people-environment relations. *American Psychologist, 45*, 641-646.
- Thompson, S. C. G., & Barton, M. A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology, 14*, 149-157.
- van de Vijver, F., & Leung, K. (1997). *Methods and data analysis for cross-cultural research*. Thousand Oaks, CA: Sage.
- Wiseman, M., & Bogner, F. X. (2003). A higher-order model of ecological values and its relationship to personality. *Personality and Individual Differences, 34*, 783-794.
- Xiao, C., & Dunlap, R. E. (2007). Validating a comprehensive model of environmental concern cross-nationally: A U.S.-Canadian comparison. *Social Science Quarterly, 88*, 471-493.

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