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The Construction of a Scale to Measure Environmental Concerns

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Abstract

Measurement issues and structure of environmental concerns (ECs) were assessed in this study. The present paper compared two different scales used in previous research to measure beliefs about awareness of consequences (ACs), or concerns, for egoistic, altruistic, and biospheric-valued objects. One hundred and ten participants from two separated Universities in Myanmar completed both the ACs and ECs scales. The findings have theoretical and practical implications for research into ECs and for applications of the value-belief-norm (extended form activation) theory. The important finding was that the ECs scale is superior to the AC Beliefs scale in terms of reliability and dimensionality of sub-scales in Myanmar samples. Thus, in order to further study the environmental attitudes, values, intention, and behaviour of the people in Myanmar, the ECs scale would be essential, beneficial, and useful for future research.

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Introduction

Environment problems have been an important issue in the past several decades. Global warming and climate change due to Greenhouse effects, deforestation and species extinction, exhaustion of fisheries, agricultural land, and pollution of air and water supplies are some of the main dangers to earth's environment (Oskamp, 2000). These environmental problems may be viewed as caused by maladaptive human behaviour (Kyi Kyi Hla, 2010; Maloney and Ward, 1973).

It has been argued that environmental problems are largely ingrained into the traditional values, attitudes, and beliefs of a given society. More than three decades ago, Maloney, Ward, and Braucht (1975) pointed out that "we must determine what

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the population knows, thinks, feels, and actually does regarding ecology and pollution" (p.787). According to Johnson, Bowker, and Cordell (2004), different populations with specific social practices and cultural traits are likely to hold different values on and attitudes toward nature or environment. Therefore, an empirical study of environmental attitudes for one's culture is of particular importance. Recently, Myanmar like some Asian neighbours badly felt the full impact of the world ecological imbalance caused by global warming and climate change on 3rd -4th May, 2008, when parts of Yangon and Ayeyarwaddy Regions were battered by the Cyclone Nargis causing many death and destruction (Kyi Kyi Hla, 2010). Again, more recently some parts of the Rakhine State also suffered many damages and losses by hitting Cyclone Giri on 22nd - 23rd October, 2010. As a result, Myanmar learnt that it is the time to emphasize the interests of this crucial environmental conservation and sustainable development although its natural environment has not yet reached the dimensions of deterioration as in developed countries. No studies, however, have yet been empirically conducted to examine the attitudes toward the environmental problems in Myanmar. Thus, the main objective of the study was to construct a scale to measure the environmental attitude of the Myanmar people.

Measurements of Attitude toward Environmental Problems

There have been two main approaches to measurement, the first by Stern et al. (1993, 1995) and more recently by Schultz (2000). Each group developed scales for the measurement of beliefs about ACs for, or attitudes of concern towards, valued objects that are representative of egoistic, altruistic, or biospheric value orientations. Studies using those scales are reviewed below. Schultz's scale is the more recent, but Stern's scale is still being used by some researchers. Indeed, there has not been a previous empirical investigation into which of the two scales has better reliability and dimensionality, except one study by Snelgar (2006).

Awareness of Consequences Beliefs Scale (The AC Beliefs Scale)

Stern et al. (1993, 1995) reported tests of their value-belief-norm model. As described above, they theorized that beliefs about ACs could arise for three types of valued object: they used the terms egoistic AC, altruistic AC and biospheric AC. To measure these AC beliefs, they constructed three scales. Items retained for each AC belief were selected by Stern et al. (1993) using a theta scaling procedure. In this

procedure, devised by Armor (1974), items for one scale are entered into a principal component analysis and those that load on the first component are retained. Then theta reliability is obtained; it is the internal consistency when each item is weighted by its loading. This procedure is carried out for each scale separately. Thus Stern et al. (1993, 1995) do not appear to have assessed the dimensionality overall of the items in their AC scales. Using this procedure, Stern et al. (1993) produced AC Belief scales containing three items each. They reported that the reliabilities of the three AC Belief scales were only moderate (thetas were .66, .62, and .56).

Stern et al. (1995) used items modified from their 1993 paper again using a theta scaling procedure. The resultant items were somewhat different from those of Stern et al. (1993), with two items for egoistic AC, two for altruistic AC, and four for biospheric AC. Theta reliabilities for the three sub-scales were better: .77, .71, and .73. Other researchers have also used the AC Beliefs scales, Joireman, Lasane, Bennett, Richards and Solaimani (2001) used items from Stern et al. (1993, 1995) to measure beliefs about egoistic (four items), altruistic (five items) and biospheric (four items) ACs. They did not conduct factor analysis for the items, but reported that the alpha values were moderate (.67, .76, and .65). Garling, Fujii, Garling, and Jakobsson (2003) measured egoistic AC, altruistic AC, and biospheric AC using three items for each from Stern et al (1993). They then carried out principal component factor analysis and reliability analysis to improve the sub-scales. After eliminating one question from each of the three sub-scales, Cronbach's α 's were .45, .42, and .54. Thus, these studies show that the reliabilities of each of the AC Beliefs scales tend to be moderate and poor, and it is not clear whether each is uni-dimensional.

Environmental Concerns Scale (ECs Scale)

An alternative approach to measurement was taken by Schultz (2000), in order to investigate what he termed ECs toward valued objects that are representative of the egoistic, altruistic or biospheric value orientations. He developed an EC scale in which several objects for each value orientation are assessed on a 7 - point scale for the importance of that object as a matter of concern to the participant in terms of environmental issues. Example objects are, for egoistic, altruistic, and biospheric value orientations respectively, my health, children, and birds. In developing his scale of 12 items Schultz initially used a larger number of items. The specific 12 items used

in the EC scale varied somewhat between the studies reported next. Schultz (2000, 2001), Schultz, Shriver, Tabanico, and Khazian (2004), and Schultz et al. (2005) collected data with the ECs scale from a range of samples including USA adults and students, and students in Spain, Germany, Czech Republic, Russia, New Zealand, India, and several countries in Latin America. For most of the countries, the highest mean score was for altruistic concerns. Of egoistic and biospheric concerns, which is the higher varies between countries. Schultz (2001) showed that the USA and Spanish samples gave higher egoistic, than biospheric, mean concern score, but the reverse tended to be seen in South and Central America samples. Samples from Brazil, Germany, Czech Republic, New Zealand, and India gave higher biospheric, than egoistic, mean concern score, whereas the Russian sample showed the opposite pattern (Schultz et al., 2005). These differences between egoistic and biospheric concerns are not large; the direction of the difference is the issue.

Schultz has assessed the factor structure of the ECs scale using structural equation modeling. In his initial report on the scale. Schultz (2000) tested three structural models: a one-factor model, of uni-dimensional EC; a two-factor model; and a three-factor model. The two-factor model was of biospheric items loading on one factor with both egoistic and altruistic items loading on another factor, following Thompson and Barton's (1994) suggestion that there are ecocentric attitudes (nature valued for its own sake) and anthropocentric attitudes (nature valued for its contribution to humanity). Schultz (2000) demonstrated that the three-factor model, of egoistic, altruistic, and biospheric concerns, fitted the data well, thus providing further support for the notion that three value-orientations underlie beliefs about ACs (Stern et al. 1993; Stern, 2000). Moreover, the three-factor model gave a significantly better fit than did the two-factor model. Schultz (2001) replicated the outcome on further samples: the three-factor model fit the data better than did the two-factor model for samples from Spain and Latin America. Reliabilities of the three sub-scales were high (.91, .92, and .94) for Schultz' (2000) sample. Reported reliabilities from other samples (Mayer & Frantz, 2004; Schultz, 2001; Schultz et al. 2004, 2005) were not always so high; nonetheless they were mostly good to high.

These studies suggested that concerns resulting from biospheric and altruistic value orientations are indeed distinct from one another. It also contains indications that Schultz' ECs scale has a better factor structure and more reliable sub-scales than does Stern and colleagues' AC Belief scale. The issue of which scale gives better

measures of these constructs is important for research questions into ECs or beliefs about ACs involving value orientations towards egoistic, altruistic and biospheric valued objects. It appears, however, that the two scales have not been directly compared. The AC Beliefs scale, which consists of a series of statements about consequences of environmental aspects for a valued object, is a different type of scale to the ECs scale, in which a series of objects for each value orientation is assessed in terms of how much ECs they evoke. Nonetheless, both scales were constructed in order to assess beliefs about consequences for, or concern towards, valued objects related to the three value orientations proposed by Stern et al. (1993) for their extended norm-activation model, the value-belief-norm theory. Thus after empirical making a comparison of the two scales, selecting one which is most appropriate for Myanmar culture is theoretically and practically useful.

Methods

Participants and procedure

Data were collected from 110 students at the East Yangon University and Sittway University in 2010. Cases with missing data were excluded listwise from the relevant scale data: 108 gave complete data for the AC Beliefs scale and the EC scale. This is a relatively small sample. Nonetheless, it is sufficient for exploratory factor analysis, provided that there are at least five participants per variable and three or more variables per factor (Gorsuch, 1983).

Materials

A set of questionnaires contained both the AC Beliefs and ECs scales.

AC Beliefs scale: For this study, all 13 items published in Joireman et al. (2001, after Stern et al., 1993, 1995) were used. The egoistic AC sub-scale consisted of four items, altruistic AC, five items, and biospheric AC four items. The items were placed in random order. The researcher asked participants to respond on a scale from 1 to 7, where 1 was strongly disagree, 4 was neutral, and 7 was strongly agree. High scores indicate beliefs that environmental degradation adversely affects valued objects and that environmental protection benefits them. The 1-7 scale was chosen to allow for easy comparison with data from the ECs scale. Joireman et al (2001) used a 7-point scale, but Stern et al. (1993) used a 4-point scale and Garling et al. (2003) used a 9-point scale.

EC's scale: The items making up the ECs scale have also varied somewhat between studies (Schultz, 2000, 2001; Schultz et al. 2004). For this study 12 items were all used with the standard instructions. The items used for each concern were: egoistic: me, my future, my lifestyle, my health; altruistic: all people, children, people in Myanmar, future generations; and biospheric: plants, marine life, birds, animals. The item order was mixed. The researcher asked participants to respond to a scale from 1 to 7, where 1 was not important, 4 was neutral, and 7 was supreme important.

Results

Exploratory component factor analysis was carried out on each scale separately. The aim was to explore dimensionalities and so various methods were used. Bivariate correlations for each pair of sub-scales are shown in Table 1.

Table 1. Correlations between sub-scales from both the AC Beliefs scale and the ECs scale

AC ego	AC alt	AC bio	EC ego	EC alt	EC bio
AC ego	-				
AC alt	.157	-			
AC bio	.062	.124			
EC ego	.060	.075	-0.44	-	
EC alt	.185	.125	.036	.534**	
EC bio	.208*	.194*	-.05	.401**	.477**

Note. * $p < .05$. ** $p < .01$. All two - tailed.

The AC Beliefs Scale

Exploratory component factor analysis: For the AC Beliefs scale, there were five components with eigenvalue greater than one. The scree plot had no clear break. Table 2(i) shows the loadings obtained when three components (following theory) were extracted in a principal component analysis with varimax rotation. The items from each sub-scale do not fall onto the same component.

In order to check all possibilities that the AC Beliefs scale may show dimensionality, other analyses were carried out. When five components (following eigenvalues) were extracted, the heaviest loadings on each component were as follows: two altruistic and one egoistic item on the first; one biospheric and three

altruistic items on the second; two biospheric items on the third; two egoistic items on the fourth; and one egoistic and one biospheric item on the fifth. An analysis was carried out in which the number of components extracted was reduced to two, in line with Stern et al. (1995) the suggestion of. Also, the principal component analyses were repeated with direct oblimin rotation, as correlations have previously been reported between the AC Beliefs sub-scales. Furthermore, two, three, four, or five factors were extracted using principal axis factoring both with varimax and with direct oblimin rotations. No clear structure was obtained with any of these analyses. Thus, it is not appropriate to attempt to label any of the factors/components. None of the AC Beliefs sub-scales is uni-dimensional.

Reliability: Values of Cronbach's α for each of the AC sub-scales were: for egoistic AC, .26; for altruistic AC, .39; and for biospheric AC, .44.

Magnitude of ACs: The mean (SD) values were as follows; for egoistic AC, 5.53 (0.75); for altruistic AC, 5.59 (0.75); for biospheric AC, 4.20 (1.07).

The ECs Scale

Exploratory component factor analysis: For the ECs scale, three components had eigenvalue greater than one. Moreover, the scree plot showed a clear break between the third and fourth factor. There is sometimes debate about whether the factor after the break should also be extracted. In this case when three components were extracted, the items from each sub-scale separated clearly with principal components analysis as shown in Table 2(ii). Other analyses were carried out as for the AC Beliefs scales. Interestingly, the same pattern of loadings was obtained for other methods as when three factors were extracted.

Reliability: Values of Cronbach's α for each sub-scale of the EC scale were: for egoistic concern, .78; for altruistic concern, .74; and for biospheric concern, .79.

Magnitude of ECs: The mean (SD) of each concern were as follows; for egoistic, 5.28 (1.04); for altruistic, 6.05 (0.88); for biospheric, 5.72 (1.09).

Table 2. Rotated Component Matrix (i) for AC Beliefs items and (ii) for ECs items measured in Study

	Components		
	1	2	3
(i) AC Beliefs Scale			
ACalt11	0.735		
ACalt13	0.716		
ACego10	0.661		
ACego1	0.448		
ACalt8		0.708	
ACbio6		0.702	
ACalt5		0.587	
ACalt2		0.511	
ACego4		0.684	
ACego7	0.364	0.617	
ACbio12		0.586	
ACbio3	0.348	0.433	
ACbio9		0.354	
(ii) EC Scale			
Me (ECego1)	0.819		
My future (ECego4)	0.761		
My health (ECego10)	0.743		
My lifestyle (ECego7)	0.567		
Birds (ECbio9)		0.79	
Plants (ECbio3)		0.776	
Marine life (ECbio6)		0.747	
Animals (ECbio 11)	0.325	0.638	
People in Myanmar country (ECalt5)			0.834
All people (ECalt12)			0.676
Future generations (ECalt8)			0.674
Children (ECalt2)	0.313		0.601

For each scale separately, three components were extracted in a principal component analysis with varimax rotation. Loadings less than .3 are omitted. Bold numbers are the largest loadings over .5 for that item.

Discussion

This study showed that the ECs scale is superior, in both factor structure and sub-scale reliabilities, to the AC Beliefs scale. Each of the ECs sub-scales has good reliability. The findings confirm indications found in previous research, reviewed in the measurements of altitude towards environmental problems section. In the present study data for both scales were obtained from the same sample, which has less previously been done. Issues about the sample should be considered. This was a relatively small sample, of around 100, but for that N there were sufficient participants per variable, and sufficient variables per factor. It was a non-probability sample and from a student population, which can lead to reduced variation in responses. Such samples are often used in this type of research, but the conclusions should be considered with reference to the nature of the sample. Further research may be appropriate. Nonetheless, in terms of dimensionality the poor performance of the AC Beliefs scale relative to the ECs scale was marked (see Table 2). Many of the statements in the AC Beliefs scale include more than one aspect, thus it is likely that these items do tap more than one of the AC beliefs. This would also explain why the correlations between ACs and ECs equivalent pairs of sub-scales are absent (see Table 1).

The results demonstrate clearly that the ECs scale is superior to the AC Beliefs scale for measurement of egoistic, altruistic, and biospheric ECs. The reliabilities of the three sub-scales were better for the ECs scale than for the AC Beliefs scale. Furthermore, in exploratory factor analyses the ECs scale gave fair clear dimensions that agreed with theory, whereas items in the AC Beliefs scale loaded on factors in a haphazard manner. This is the second time that the reliability and dimensionality of these two scales have been investigated in the same sample. Further research may be appropriate, however, in samples drawn from other populations. The finding has consequences for applications of the value-belief-norm theory (Stern et al., 1993, 1995). Both scales were developed in order to assess the concern towards, or beliefs about consequences for, the three value orientations proposed by Stern et al. (1993) as part of their theory. That theory, or similar modifications, has been applied to

explanations of a range of environmental attitudes and behaviour. In some of those investigations the AC Beliefs scale was used to measure egoistic, altruistic, and biospheric concerns, yet the subscales do not distinguish those dimensions. Thus, the ECs scale is recommended for any research requiring separate measures for these dimensions. In other words, the ECs scale should be used, in preference to the AC Beliefs scale, to measure concerns about the environment resulting from egoistic, altruistic, and biospheric value orientations.

Methodological problems with measurement in this field should be mentioned. Social desirability can affect responses and may be responsible for mean scores being relatively high. This has been commented by others (e.g. Garling et al., 2003; Schultz et al, 2004). Some researchers have measured egoistic, altruistic, and biospheric concerns or ACs using scales other than those used in this paper. Stern, Dietz, Abel, Guagnano and Kalof (1999) asked, with nine items and a 3-point response scale, whether each of three environmental issues would be a problem for self and family, the country as a whole, or for other species of plants and animals. A future study could assess whether these types of scale and the EC scale have different levels of social desirability response.

In summary, the research finding reported in this paper has theoretical and practical implications for research into ECs, and for applications of the value-belief - norms (extended norm activation) theory. The important finding was demonstrated that the ECs scale is superior to the AC Beliefs scale in terms of reliability and dimensionality of sub-scales in Myanmar samples. Therefore, in order to study the environmental attitudes, values, intention, and behaviour of the people in Myanmar, the ECs scale would be essential, beneficial, and useful for future research.

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