ADAPTATION AND VALIDATION OF THE CONNECTEDNESS TO NATURE SCALE FOR THE USE IN SRI LANKA

E. A. S. K. Somarathne[1,2*], E. Lokupitiya[1], M.W. Gunathunga[3]

1 – Research Promotion and Facilitation Center, Faculty of Medicine, University of Colombo, Colombo 08, Sri Lanka.
2 – Department of Zoology and Environment Sciences, Faculty of Science, University of Colombo, Colombo 03, Sri Lanka.
3 – Department of Community Medicine, Faculty of Medicine, University of Colombo, Colombo 08, Sri Lanka.

*Corresponding author, Email address: sksomarathne@stu.cmb.ac.lk

INTRODUCTION

Environmental research today mostly targets the reduction of the gap between man and nature. If people are to successfully address environmental concerns, they must feel a sense of being part of the larger natural world. According to available scientific evidence, one's connection with nature fosters eco-friendly behaviour.

Connectedness with nature examines the cognitive relationship between an individual and the natural world (Schultz, 2002; Schultz, Shriver, Tabanico, & Khazian, 2004). Mayer and Frantz (2004) define nature connectedness as an individual's emotional and experiential connection with the broader natural world. Several tools are available to investigate implicit and explicit connection with nature. Connectedness to Nature Scale (CNS) might be the most studied tool by researchers from a range of disciplines in different parts of the world (Navarro, Olivos, & Fleury-Bahi, 2017).

The CNS is a valid and reliable multi-item scale that measures oneness with nature. The reliability of the scale (Cα) was 0.84 (Mayer & Frantz, 2004). According to the results of the validation study, it correlates with biospheric concerns, altruism, ecological behaviours, consumerism and environmentalism. Further, these results have been re-observed in studies on validation of CNS under different cultural contexts (Navarro et al., 2017; Perrin & Benassi, 2009).

The majority of Sri Lankans speak *Sinhala*. As a nation, we try to conserve our natural resources by promoting pro-environmental behaviours. We wonder, if we adapt and validate the CNS to *Sinhala* speaking context, it may enhance the effectiveness of scholars' efforts on experimental approaches in conserving nature through bridging environmental attitudes and pro-environmental behaviours. Thus, our objective was to adapt and validate the CNS in the *Sinhala* speaking context. This is the 1st research study which focused on adapting and validating a tool that assesses an individual's explicit connection with nature in Sri Lankan context.

METHOD
Adaptation of the CNS

Adaptation of the CNS to *Sinhala* speaking cultural context was carried out according to the International Test Commission (ITC) guidelines for translating and adapting tests. Before starting the adaptation process, permission was obtained through emailing the holders of the intellectual property rights of the CNS. The test translation of the CNS was intended to be used among Buddhist meditators who are regularly meditating under a large scale study on 'meditation, connectedness to nature and climate mitigation.

After receiving the consent for adapting CNS to the Sri Lankan context, it was translated into Sinhala (forward translation) by 2 independent bilingual translators who know both the language and culture. In particular, they were experts in the fields of environmental science and psychology. Another bilingual translator who knows questionnaire development and validation, psychology and environmental science, synthesized a draft Sinhala translation of CNS (CNS_SS1) after going through both forward translations. In the middle of this process to get clear with the direction and meanings of item number 9 and 10, the 1st author of the article wrote to one of the intellectual property holders of the original CNS. The CNS_SS1 was checked by a Sinhala graduate for any grammatical and spelling errors. The changed CNS_SS1 (CNS_SS2) was back-translated (CNS_BE) by another bilingual translator with expertise in local culture and environmental sciences.

The CNS_BE was discussed among 3 professionals in environmental science, cognitive science and psychology in Sri Lanka along with the original version of the CNS by the 1st author of this research article. Further, CNS_BE was emailed to the original developers to get their opinions on the CNS-BE. Changes were made in CNS_SS2 and resulting CNS_SS3 was sent to the same translator who supported for back-translation to do changes in CNS_BE. Based on the changes in CNS_BE, rechecking the CNS_BE along with the original CNS was carried out.

Ensuring the judgmental validity

As there were no considerable changes needed in CNS_SS3, it was pre-tested among 5 natives of Sri Lanka who speak Sinhala. Changes were made after receiving their feedback on the structure and content of the CNS_SS3 (CNS_SS4). Accordingly, face and content validity ensured CNS_SS4 was sent to a Delphi group to ensure the consensual validity of the translation.

Two rounds of Delphi process were conducted. The Delphi team (n =7) consisted of experts in the fields of psychology, cognitive science and environmental sciences and some of them had in-depth knowledge on questionnaire designing and validation. The team members rated each statement using a 0-9 Likert scale under 3 criteria; retaining the meaning when translated to Sinhala, appropriateness of each item to be used with 30-55 years old Buddhist meditators and cultural relevance to use in a Sri Lankan setting.

At the end of 1st round of the Delphi process, CNS_SS5 resulted as a result of evaluating all responses received through 1st round-Delphi process. The evaluation of responses received from the Delphi team was carried out by 3 authors of this article and a person who is familiar with questionnaire development and psychology. Then, the CNS_SS5 had undergone the 2nd round of the Delphi process.

Based on the rates and feedback obtained, CNS_SS5 was revised (CNS_SS6) by the Delphi response-evaluating team. The CNS_SS6 was pre-tested among 5 individuals (non-meditators) to determine issues related to administering it. After evaluating the received comments, the pre-final Sinhala version of the CNS_SS7 was designed.

Ensuring the construct validity and reliability

The CNS_SS7 was administered to 30 *Sinhala* speaking individuals to collect the data to check the reliability and to ensure the construct validity of the final version of the CNS Sinhala version (CNS-Sin). The statistical software: IBM SPSS-20 was used in statistical analyses: descriptive statistics, reliability analysis and exploratory factor analysis (EFA). As the original scale of CNS has 1 predominant factor (Mayer & Frantz, 2004), 1 factor was forced in EFA and measures were taken to identify the CNS-Sin with the best psychometric properties through factor loadings and reliability analysis.

Characteristics of the study participants

The mean age of the participants was 43.53 ± 1.89 years. Among the participants, there were 15 females and 15 males and 96.70 % of participants were living in Western province of Sri Lanka. All of the participants, except one, had completed secondary schooling. Further, 25 participants held tertiary education qualifications. In terms of professional status, 83.30 % were working and 16.70 % were unemployed. The margin of error with regard to the reference population (i.e. Sinhalese according to the Census report in 2012) is ± 17.89 % at 95 % confidence level.

RESULTS
Adaptation of CNS and Ensuring judgmental validity

The CNS_SS1 was built as a self-reported questionnaire with 14 items, the same as with the original version of the CNS. Sri Lankan reviewers who evaluated CNS_SS2 along with the CNS_BE suggested changing 2 items and one instruction guideline. Also, item number 13 of the CNS_BE was changed based on the comment received from the intellectual property holder of the CNS. Pre-testing of CNS_SS3 further confirmed that there were no considerable syntax errors and overall, the 5 individuals didn't express any inconvenience in understanding the content of the CNS_SS3.

In the 1st round of the Delphi process, 26.53 % of ratings were in the score range of 4–6. None of the Delphi members had rated any of the items under the category 0-3. Changes were suggested for 12 items and mainly suggested changes were regarding the used Sinhala words and their applicability in the society including meditators.

Out of all ratings in the 2nd round of the Delphi process, 9.52 % of scores were in the range of 4-6. Based on the comments and scores received from the Delphi members, 6 items in CNS-SS5 were modified. Under the pretesting of CNS_SS6, 60 % of individuals mentioned that the content of the questionnaire is understandable and very clear. The translations of the words "web of life", "nonhuman", "life force" and "kinship" were subjected to modifications based on the comments received (Table 1).

Table 1 Back translations of terms modified

Word in the original CNS	Back translation of the word in the CNS-Sin
Web of life	integrated biological system
Non-human	All other living things
Lifeforce	A life-sustaining force
Kinship	A closed relationship

Ensuring the construct validity
Initial descriptive statistics

The Kaiser-Meyer-Olkin (KMO) value was 0.574 ($p < .001$). Bartlett's test for sphericity was significant ($\chi2=209.510$, $p < .001$). Based on these initial statistical values, it was decided to conduct exploratory factor analysis (EFA). Cronbach alpha ($C\alpha$) for the CNS-Sin with all 14 items was 0.81.

Exploratory factor Analysis

The total variance explained by the one factor was 34.20 %. Except for item 5, 13 and reversed items 4 (R4) and 14 (R14), all the items had positive loads with values greater than 0.4. The CNS-Sin without item 4R, 5, 13 and R14 showed good internal reliability ($C\alpha = 0.84$). The descriptive statistics and factor loadings have been shown in Table 2.

Table 2 Exploratory factor analysis of principal components, reliability index and corresponding descriptive statistics of the CNS-Sin.

Item number	Variable (original item)	Factor	*Cα	M	SD
1	I often feel a sense of oneness with the natural world around me.	0.436	0.831	4.30	0.794
2	I think of the natural world as a community to which I belong.	0.858	0.808	4.60	0.724
3	I recognize and appreciate the intelligence of other living organisms.	0.504	0.831	4.43	0.679
6	I often feel a kinship with animals and plants.	0.776	0.800	3.73	1.258
7	I feel as though I belong to the Earth as equally as it belongs to me.	0.611	0.824	3.67	1.269
8	I have a deep understanding of how my actions affect the natural world.	0.465	0.834	4.13	1.167
9	I often feel part of the web of life.	0.870	0.792	4.33	1.028
10	I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'.	0.702	0.818	4.37	0.928
11	Like a tree can be part of a forest, I feel embedded within the broader natural world.	0.719	0.816	4.10	1.242
R12	When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in	0.408	0.841	2.67	1.093

* Cα = Cronbach's alpha if item deleted, M = Mean, SD = Standard Deviation

DISCUSSION

This study was conducted along with a large- scale study on "meditation, nature connectedness and climate mitigation" to ensure the validity and reliability of the translated version of the CNS among *Sinhala* speaking population to an acceptable level. Validating the CNS-Sin enables investigating connectedness to nature in Sri Lanka where this subject is gaining interest under the emerging field of environmental psychology among environmental researchers.

De Zoysa, Rajapakse, & Newcombe, (2005) categorized Delphi-scores into three categories: 0-3 (unacceptable score), 4-6 and 7-9 (acceptable agreement). If 70% of the expert ratings for an item fell within the 0-3 range, it was deemed inappropriate and should be removed, while if 70% of the expert ratings fell within the 4-6 or 7-9 categories, the item was deemed suitable and should be kept. More than 70% of panel members' scores fell within the 7-9 range as a result of certain deletions and modifications of statements.

As mentioned in other CNS validation studies (Mayer & Frantz, 2004; Navarro et al., 2017; Perrin & Benassi, 2009), the`1-factor structure was forced in the EFA. Factors for items 5, 13 and R14 were not loaded under the considered extraction method. Items with no loadings can be removed from a scale (Hair, Black, Babin, Anderson & Tatham, 2006). Removing items with no loadings caused to enhance the internal consistency of the scale which was the same as the Cα value of the original CNS. Also, as mentioned in other psychometric validation studies, excluding certain items is important in order to obtain the best psychometric qualities in a particular cultural context (Olivos & Aragonés, 2011; Pasca, Aragonés, & Coello, 2017). Even though the sample size was lower under this analysis, the obtained KMO value was greater than 0.5; therefore, statistically, there were no sample size issues to conduct EFA. The construct validity of the CNS-Sin was ensured among *Sinhala* speaking Buddhist meditators in Sri Lanka. Based on religion, Sri Lanka is a multicultural country that gives shelter for various multicultural people with

various lifestyles and perspectives on nature. Hence, the marked cultural differences should be taken into account during future applications. Further, the validity of CNS-Sin can be improved through ensuring discriminant and convergent validity.

CONCLUSIONS

This is the 1st attempt that was made in Sri Lanka to scientifically validate a tool that can be utilized in studying explicit connection with nature in a *Sinhala* speaking context. Researchers who investigate psychology in environmental concerns can use this tool in assessing one's experiential connection with nature which may support in creating an environmentally sustainable society. It can be concluded that CNS-Sin is a valid and reliable tool to measure connectedness to nature. As this opens the doors to investigate one's environmental beliefs, psychometric data collected through this tool might be helpful to enhance the fruitfulness of experimental approaches in environmental management in the future.

REFERENCE

Department of Census and statistics. (2012). Distribution of population according to Ethnicity and Religion. *Sri Lanka Census of Population and Housing, 2011*, Department of Census and Statistics. Retrieved from http://www.statistics.gov.lk/pophousat/cph2011/index.php?fileName=FinalReportE&gp=Activities&tpl=3

De Zoysa, P., Rajapakse, L., & Newcombe, P. A. (2005). Adaptation and validation of the parent-child conflict tactics scale for use in Sri Lanka. *Ceylon Medical Journal, 50*(1), 11–14. https://doi.org/10.4038/cmj.v50i1.1582

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis 6th Edition.

Hinkin, T. R. (1995). A Review of Scale Development Practices in the Study of Organizations. *Journal of Management*, *21*(5), 967–988. https://doi.org/10.1177/014920639502100509

Mayer, F. S., & Frantz, C. M. P. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, *24*(4), 503–515. https://doi.org/10.1016/j.jenvp.2004.10.001

Navarro, O., Olivos, P., & Fleury-Bahi, G. (2017). "Connectedness to nature scale": Validity and reliability in the French context. *Frontiers in Psychology*, *8*(DEC), 1–8. https://doi.org/10.3389/fpsyg.2017.02180

Olivos, P., & Aragonés, J. I. (2011). Propiedades psicométricas de la Escala de Identidad Ambiental (EID). *Psyecology*, *2*(1), 65–74. https://doi.org/10.1174/217119711794394653

Pasca, L., Aragonés, J. I., & Coello, M. T. (2017). An analysis of the connectedness to nature scale based on item response theory. *Frontiers in Psychology*, *8*(AUG), 1–6. https://doi.org/10.3389/fpsyg.2017.01330

Perrin, J. L., & Benassi, V. A. (2009). The connectedness to nature scale: A measure of emotional connection to nature? *Journal of Environmental Psychology*, *29*(4), 434–440. https://doi.org/10.1016/j.jenvp.2009.03.003

Schultz, P. W. (2002). Inclusion with Nature: The Psychology Of Human-Nature Relations. *Psychology of Sustainable Development*, 61–78. https://doi.org/10.1007/978-1-4615-0995-0_4

Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, *24*(1), 31–42. https://doi.org/10.1016/S0272-4944(03)00022-7

ETHICAL APPROVAL

This study was approved by the Ethics Review Committee of Faculty of Medicine (FOM) at University of Colombo (UOC), Sri Lanka (EC/19/103).