






A methodological guide for translating study instruments in cross-cultural research: Adapting the 'connectedness to nature' scale into Chinese

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Abstract

1. Ecologists and conservation scientists use social science research methods to carry out studies around the world. The language and cultural context in which study instruments are applied often differ from the context in which they were originally developed. Study instruments used in cross-cultural research need to maintain equivalency in order to ensure that the results and conclusions are not affected. Translation is a crucial part of research design, so a carefully planned methodological approach needs to be taken to adapt existing tools.
2. We present a clear, concise and easy-to-use procedure for researchers in conservation and ecology to translate study instruments. This five-step guide first requires researchers to recruit a diverse and balanced team of translators, who are tasked with performing a series of forward and back-translations. A committee approach is used to resolve differences in format, wording, grammar, sentence structure, item meanings, relevance and culturally specific references to reach a consensus on the best possible translation, which can then be pilot tested and validated.
3. As a case study to demonstrate how our method works, we adapted the 'connectedness to nature' scale into Chinese. Originally created in English by Mayer and Frantz, the 'connectedness to nature' scale measures an individual's emotional connection to nature, which is an important predictor of environmental behaviour. It is theorized that reconnecting humans to the natural world can help mitigate environmental crises.
4. Although no method is fail-safe, by following the structured, five-step method we present in this paper, ecologists and conservationists can employ a more thorough and rigorous approach to translating their study instruments for cross-cultural research than commonly used methods like direct translation. Ultimately,

researchers must decide on what translation procedures are appropriate for their work given constraints on time and resources.

KEYWORDS

back-translation, connectedness to nature scale, cross-cultural research, study instruments, translation, validity

1 | INTRODUCTION

Scientists conduct social research around the world, which often requires researchers to navigate the challenges associated with foreign languages and cultures. Study instruments are often developed in one language before being translated—likely with limited resources—for use in the field (Cha, Kim, & Erlen, 2007). Most instruments used for studying environmental concerns were originally developed in English (Navarro, Olivos, & Fleury-Bahi, 2017). However, cultural differences mean that instruments which have been validated in the original language and social context of development may be inapplicable for people elsewhere. For instruments to retain their measurement properties, translations must be made not only in terms of language but also made to remain relevant to respondents in a different country who may have different values and beliefs (da Mota Falcão, Ciconelli, & Ferraz, 2003).

A translation's comprehensibility and cultural relevance influences the strength of findings and recommendations (Sperber, 2004), and methodological problems can threaten the validity of cross-cultural research (Peña, 2007). Vocabulary and terminology can lack equivalents across languages, while idioms, grammar and syntax can also pose challenges (Sechrest, Fay, & Zaidi, 1972). Maladapted questions and measures can lead to inaccurate, misinterpreted or erroneous conclusions with potential downstream policy impacts (Sperber, Devellis, & Boehlecke, 1994). Ensuring the linguistic, functional, cultural and metric equivalence of study instruments is also vital for fairness and integrity if different people or cultures are being compared (Peña, 2007).

Despite its importance, translation is often an afterthought in study design. Methods vary greatly in procedure and rigour (Sperber, 2004). Researchers in conservation and ecology regularly rely on direct forward translation followed by pilot testing (Biggs, Hall, & Stoeckl, 2012), which is simple and cost-effective. However, a translator's ability to navigate linguistic and cultural challenges is critical for translated instruments to maintain validity (Brislin, 1970), and direct forward translation relies on a single interpretation—sometimes by a single person—to get things right. More rigorous methods can improve reliability, as cross-cultural adaptation involves not only the literal translation of words and sentences but also ensuring that these are appropriate to cultural contexts and local lifestyles (Guillemin, Bombardier, & Beaton, 1993).

Translation should be treated as a crucial part of cross-cultural research in conservation and ecology which merits the investment of time and resources (Sperber, 2004). Procedures should be sufficiently rigorous to ensure that carefully crafted questions and

measures maintain their integrity (Sousa & Rojjanasrirat, 2011). Yet there is no straight answer to the question 'How good does a translation have to be before it is usable?'. Ultimately, translation should not be daunting, overbearing or overwhelming. Here, we present a systematic, stepwise methodology for translating study instruments in cross-cultural conservation and ecology research to help limit the impact that differences in language and culture can have on study findings. This method draws from existing guidelines and recommendations in health and medicine where instrument equivalence is especially critical in cross-cultural research (Guillemin et al., 1993; Sousa & Rojjanasrirat, 2011; Sperber et al., 1994). We embed a case study in a step-by-step breakdown, translating the connectedness to nature scale (CNS; Mayer & Frantz, 2004) from English to Chinese.

2 | FIVE SIMPLE STEPS

2.1 | Step 1: Recruit translation team

The first step is to recruit translators. A team of translators is likely to produce a higher quality translation than a single person, as interaction creates opportunities to correct individual errors, resolve divergent interpretations and minimize personal idiosyncrasies (Guillemin et al., 1993). It is important to consider the translators' individual abilities; the team should consist of both translators who are well-versed in the relevant scientific concepts and translators who are either professionally qualified or have native language ability with cultural familiarity. A combination of skills, expertise and backgrounds can help translations retain the meanings of technical language while accounting for linguistic and contextual nuances. Drawing from relevant literature on translation best practices (Guillemin et al., 1993; Sousa & Rojjanasrirat, 2011; Sperber et al., 1994), we suggest that a minimum of four translators should be arranged into pairs with balanced expertise (Figure 1a). Project-specific considerations, like the use of multiple dialects in the study population, may need to be addressed. Additional criteria, like requiring translators to be residents in the study's target country, can further ensure cultural equivalence (Eremenco, Cella, & Arnold, 2005).

2.1.1 | Case study: CNS translation

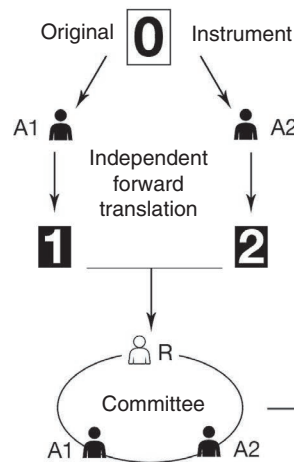
Self-report scales are widely used to gain insight into environmental attitudes (Tam, 2013). As a case study of our translation

FIGURE 1 Stepwise procedure for the cross-cultural adaptation of study instruments. (a) Researchers first recruit a diverse and balanced team of translators. (b) The first pair of translators produce forward translations independently. These are compared and amalgamated into a single, combined forward translation. (c) The second pair of translators produce back-translations independently. (d) A committee consisting of the researchers and the whole translation team examine all versions of the instrument to resolve differences in format, wording, grammar, sentence structure, item meanings, relevance, and culturally specific references. Once a consensus is reached on the best possible translation, this consolidated draft can then be pilot tested and validated

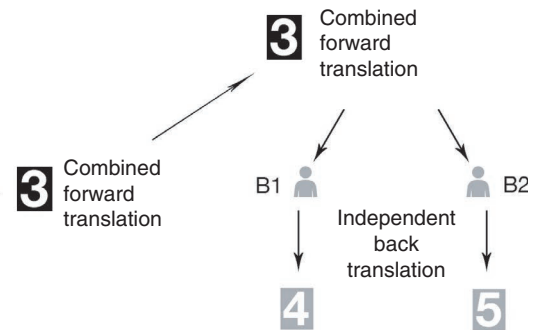
(a) Recruit translation team

Researcher	R	
Translators	Topical familiarity	Native language ability or qualified translator
Pair A	A1	A2
Pair B	B1	B2

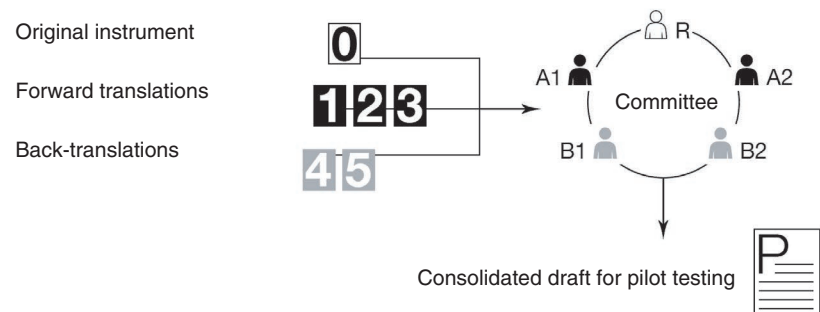
(b) Forward translation



(c) Back-translation



(d) Committee consolidation



methodology, we applied this five-step process to adapt the CNS from English to Chinese. This was done as part of a study on the medicinal use of rhino horn in China, in which traditional Chinese medicine (TCM) practitioners in Guangdong province were asked to complete the CNS.

The CNS is a 14-item self-report scale developed around the idea that reconnecting humans to the natural world can help mitigate environmental crises (Table 1). The original instrument was developed in English and measures a single factor: feeling emotionally connected to the natural world (Mayer & Frantz, 2004). The CNS has been translated into various languages in the past

(Navarro et al., 2017; Olivos, Aragonés, & Américo, 2011), and has been administered in diverse cultural contexts, including in Chinese-speaking societies (Dong et al., 2020; Li & Wu, 2016; Tam, 2013; Tam, Lee, & Chao, 2013). Certain translations of the CNS are readily accessible to researchers, including Spanish (Olivos et al., 2011) and French (Navarro et al., 2017) adaptations. However, although the CNS has previously been adapted into and administered in Chinese (Dong et al., 2020; Li & Wu, 2016), a Chinese version of the CNS has yet to be published in the peer-reviewed literature.

In adapting the CNS to Chinese, we decided to maintain three reverse-worded items in the original instrument (Mayer &

TABLE 1 All versions of the CNS (Mayer & Frantz, 2004) produced in our five-step translation procedure (see Appendix A in Supporting Information for the Simplified Chinese version of the individual steps in the translation process)

	Original in English	Forward translation into Chinese (presented in traditional Chinese)		
		Translator 1	Translator 2	Merged version
1	I often feel a sense of oneness with the natural world around me	我感到與大自然融為一體。	我常感到與環繞我的自然世界合一	我常感到與環繞我的自然世界融為一體
2	I think of the natural world as a community to which I belong	我視大自然為我所屬的一個群體。	我想自然世界是我所屬的社區	我認為自然世界是我所屬的一個群體
3	I recognize and appreciate the intelligence of other living organisms	我認識並欣賞其他生物的智慧。	我承認並欣賞其他生物的智慧	我承認並欣賞其他生物的智慧
4*	I often feel disconnected from nature	我感到與大自然很疏離。	我常感到與大自然之間沒有連繫	我常感到與大自然沒有連繫
5	When I think of my life, I imagine myself to be part of a larger cyclical process of living	我視自己為整個大自然生命循環的其中一部份。	當我想及我的生命時,我想像自己是更大的生命循環的一部分	當我想及我的人生時,我想像自己是處於比我個人更大的一個大自然生命週期
6	I often feel a kinship with animals and plants	我與動植物有著堅定而且親近的關係。	我常感到與動物和植物間的親緣關係	我常感到與動植物有近親關係
7	I feel as though I belong to the Earth as equally as it belongs to me	我覺得我是屬於大自然的,就好像大自然是我的一部份一樣。	我感到我屬於地球,就等於地球屬於我	我感到我是屬於大自然的,就等於大自然是屬於我的
8	I have a deep understanding of how my actions affect the natural world	對於我的行為會如何影響到大自然,我有深刻的了解。	我對於我個人的行為如何影響大自然有深刻的理解	我深刻地理解我的行為如何影響大自然
9	I often feel part of the web of life	我覺得我是整個大自然生命網絡中的一員。	我常覺得自己屬於生命網絡的一部分	我常感到自己是生命網絡的一份子
10	I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	我覺得所有棲於大自然的人類和非人類都分享著同一份生命力量。	我感受到地球的所有居者,人類及非人類,均源自同一生命原動力	我感到所有棲息在地球的人類和非人類生物都分享著共同的生命力量
11	Like a tree can be part of a forest, I feel embedded within the broader natural world	就好像一棵樹是森林的一員一樣,我是大自然的一部份。	正如就像一棵樹可以是森林的一部分,我覺得自己屬於更廣大自然世界的一部分	就像一棵樹是森林的一員,我感到自己是大自然的一員
12*	When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature	當考慮我在大自然的位置時,我認為我是位於階梯中最頂層的一員。	當我想到自己在地球的位置時,我認為自己是大自然階梯之中較為高級的一員	當我考慮我在地球的位置時,我認為自己是大自然階梯頂層的一員
13	I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees	我覺得我只是大自然的一小部份,並不會比起地上的草或樹上的鳥重要。	我常感到我只是環繞我的自然世界的一小部分,而我並不比地上的草或樹上的鳥更為重要	我常感到我只是大自然的一小部份,而我並不比地上的草或樹上的鳥更重要
14*	My personal welfare is independent of the welfare of the natural world	我的福祉與大自然的福祉並不相干。	我個人的福祉獨立於自然世界的福祉之外	我個人的福祉與大自然的福祉是各自獨立的

Note: Items marked with * were reverse-scored.

Frantz, 2004) despite reliability and validity concerns over such designs (Woods, 2006; Zhang, Noor, & Savalei, 2016). A native Chinese speaker on our research team coordinated all translation activities. Four bilingual, ethnically Chinese translators were recruited—three from Hong Kong and one from Macau. The translators were split into mixed pairs based on expertise and background: Pair A consisted of a qualified English–Chinese translator and an environmental psychology professor, while Pair B consisted of an English–Chinese dual-language program schoolteacher and a doctoral graduate in conservation.

2.2 | Step 2: Forward translation

This step involves the first pair of translators only, who independently translate the source material into the target language. If a professional translator was recruited, he or she should produce one of these forward translations (Eremenco et al., 2005). The two versions are then amalgamated into a single forward translation using a committee approach (Figure 1b). If the researcher is bilingual in the source and target languages, the committee should consist of the bilingual researcher and the two Pair A translators, all of whom should be actively involved in

Back-translation into English		Final translation in traditional Chinese	Final translation in simplified Chinese
Translator 3	Translator 4		
I often feel I am in unison with my surrounding, natural environment	I often feel that I am a part of the surrounding natural environment	我常感到與環繞我的自然世界融為一體	我常感到与环绕我的自然世界融为一体
I feel I am part of the natural world, with the natural world being a community	I believe that I belong to the same community as nature	我認為自然界是我所屬的一個群體	我认为自然界是我所属的一个群体
I acknowledge and appreciate the intelligence of other living things	I acknowledge and appreciate the intelligence of other organisms	我承認並欣賞其他生物的智慧	我承认并欣赏其他生物的智慧
I often feel I am not connected to nature	I often feel disconnected with nature	我常感到與大自然沒有連繫	我常感到与大自然没有连系
When I think of my life, I believe that I am only a part of a bigger, natural cycle of living	When I think about my life, I (can) imagine myself belonging to a greater/broader natural life cycle	當我想及我的人生時, 我想像自己是處於比我個人更大的一個大自然生命週期	当我想及我的人生时, 我想像自己是处于比我个人更大的一个大自然生命周期
I often feel I am closely related to other animals and plants	I often feel that I have a close/intimate relationship with animals and plants	我常感到與動植物有親近的關係	我常感到与动植物有亲近的关系
I feel I belong to the natural world, as much as the natural world belongs to me	I feel that I belong to nature, and vice versa	我感到我是屬於大自然的, 就等於大自然是屬於我的	我感到我是属于大自然的, 就等于大自然是属于我的
I thoroughly understand how my behaviour affects the natural world	I thoroughly understand how my behaviour affects the natural environment	我深刻地理解我的行為如何影響大自然	我深刻地理解我的行为如何影响大自然
I often feel I am part of 'the web of life'	I often feel that I am a part of the network of life	我常感到自己是生命網絡的一份子	我常感到自己是生命网络的一份子
I feel that all living and non-living things on Earth share the same (living) energy	I feel that all inhabitants of the Earth share the same energy source	我感到所有棲息在地球的人類和其他生物都分享著共同的生命力量	我感到所有栖息在地球的人类和其他生物都分享着共同的生命力量
Just as a tree is a part of the forest, I feel I am a part of nature	Like a tree to a forest, I feel that I am a part of nature	就像一棵樹是森林的一員, 我感到自己是大自然的一員	就像一棵树是森林的一员, 我感到自己是大自然的一员
When I consider my position on Earth, I believe I am one of the beings at the top of the natural order	When I think about my position on Earth, I feel that I am a member at the top of the ecological pyramid	當我考慮我在地球的位置時, 我認為自己是大自然階梯頂層的一員	当我考虑我在地球的位置时, 我认为自己是大自然阶梯顶层的一员
I often feel I am only a small part of the natural world, and that I am not more important than the grass on the ground or the birds in the trees	I often feel that I'm just a small part of nature, and that I'm not more important than grass or the birds on the trees	我常感到我只是大自然的一小部份, 而我並不比地上的草或樹上的鳥更重要	我常感到我只是大自然的一小部份, 而我并不比地上的草或树上的鸟更重要
I feel that the prosperity of myself and nature are independent of each other	My personal well-being and that of nature is independent of each other	我個人的福祉與大自然的福祉是各自獨立的	我个人的福祉与大自然的福祉是各自独立的

identifying differences, reconciling discrepancies and proposing alternatives. If none of the researchers are bilingual, it becomes more critical for both forward translators to be actively engaged, and recruiting a third bilingual person to the committee would be ideal (Eremenco et al., 2005; Sousa & Rojjanasirat, 2011).

2.2.1 | Case study: CNS translation

Each of the two translators in Pair A produced a forward translation of the CNS. The bilingual researcher and the two translators

used a committee approach to identify discrepancies and agree on resolutions, producing a single forward translation for the next step (Table 1).

2.3 | Step 3: Back-translation

Independently, the second pair of translators back-translate the amalgamated forward translation from Step 2 to produce two source-language versions of the instrument (Figure 1c). This should be carried out blindly, whereby the translators have no access to the

original instrument. These back-translations will subsequently be compared with the original to identify disparities and improvements to be made.

Back-translation can amplify misunderstandings and misinterpretations generated in forward translation, making them easier to spot and rectify (Guillemin et al., 1993). However, back-translation is not problem-free despite being an established technique in medical and psychosocial research (Ozolins, 2009). For instance, an experienced translator may be able to take poorly translated instrument and produce a back-translation that is similar to the source material, inadvertently correcting mistakes made in forward translation. Inherent differences between languages mean that back-translations can regain grammatical forms present in the original instrument that were stripped in forward translation (Brislin, 1970; Sperber, 2004). Nevertheless, back-translation provides an opportunity for errors to be caught, which can ultimately help researchers maintain instrument equivalence (Cha et al., 2007).

2.3.1 | Case study: CNS translation into Chinese

Translators in Pair B back-translated the amalgamated forward translation produced in Step 2. They did so independently, producing two back-translated English versions of the CNS (Table 1).

2.4 | Step 4: Committee consolidation

To make improvements to the forward translation, a committee comprised of the researcher and the entire translation team should examine the similarities and differences between the source material and the back-translations with regards to format, wording, grammar, sentence structure, item meanings, relevance and culturally specific idioms or colloquialisms (Figure 1d; Brislin, 1970; Guillemin et al., 1993; Sousa & Rojjanasrirat, 2011). The aim is to produce a single, modified forward translation that is ready for pilot testing. Should the committee be unable to resolve all discrepancies and reach a consensus, recruiting more translators to repeat Steps 2 and 3 to produce additional forward and back-translations may be necessary.

It would be ideal to involve the developer of the original instrument at this stage, which allows any issues or ambiguities surrounding the original intention of items to be addressed directly (Sousa & Rojjanasrirat, 2011). Time and resources permitting, the researcher can consider an additional step of recruiting people fluent in the source language to compare the original instrument with the back-translations and rate individual items on language comparability and interpretability to flag potentially problematic items (Sperber, 2004). Researchers can also consider consulting members of the study's target population on the translation's linguistic and cultural suitability (Guillemin et al., 1993).

2.4.1 | Case study: CNS translation

The researcher and the four translators examined the differences between the two back-translated scales from Step 3 and the original CNS. A committee approach was taken to identify discrepancies and make adjustments to improve comprehensibility and cultural relevance, producing a Chinese version of the CNS for pilot testing (Table 1).

2.5 | Step 5: Pilot test and finalize

Pilot testing is carried out to correct any errors or problems and ensure that the final translation has maintained equivalence before researchers deploy the instrument in the field (Eremenco et al., 2005). The translation should be pilot tested with 10–40 monolingual members of the study's target population, who are to evaluate and provide feedback on the instructions, response format and item clarity (Sousa & Rojjanasrirat, 2011). Researchers should probe respondents to explain their understanding of individual items to ensure that equivalency has been maintained.

Responses from pilot testing are assessed for internal consistency reliability to identify items that warrant further adjustment (Eremenco et al., 2005; Guillemin et al., 1993). Further psychometric testing using established approaches (e.g. test–retest reliability, construct-related validity, factor structure and instrument dimensionality) will give researchers greater confidence in their study instruments (Sousa & Rojjanasrirat, 2011). Additional pilot testing with bilingual members of the target population can also be useful for validating translations, although their responses may not be generalizable for a monolingual population because bilingual individuals may have adopted values, attitudes and cultural norms associated with their second language (Cha et al., 2007; Sperber, 2004; Sperber et al., 1994).

2.5.1 | Case study: CNS translation

We piloted the Chinese version of the CNS in May and June 2018 with 30 TCM practitioners in Hong Kong. The vast majority of people in Hong Kong are bilingual due to its British colonial history, most with Chinese as their first language with varied English competency (Hong Kong Government, 2019). Demographic data were not recorded for this sample, although it reflected the trend that most TCM practitioners are male. Our translated CNS demonstrated high internal consistency reliability (Cronbach's $\alpha = 0.89$). When respondents were probed to provide feedback on item clarity, one third noted that item 5 was wordy although comprehensible. The translation team had noted during the committee roundtable in Step 4 that the concept of a 'life cycle' or a 'circle of life' was tricky to translate into Chinese. We reviewed the different wording options available, and decided to make no further changes to item 5, as this particular item remained understandable and the reliability of instrument overall was satisfactory.

TABLE 2 Exploratory factor analysis of our Chinese CNS (Guangdong sample, $n = 84$)

Item	Original English	Traditional Chinese	Simplified Chinese	M	SD	Asymmetry ^a	Kurtosis ^b	Cronbach's α if removed	Factor loading ^c
1	I often feel a sense of oneness with the natural world around me	我常常感到與環繞我的自然世界融為一體	我常常感到与环绕我的自然世界融为一体	3.96	0.68	-0.65	1.15	0.70	0.59
2	I think of the natural world as a community to which I belong	我認為自然世界是我所屬的一個群體	我认为自然世界是我所属的一个群体	4.08	0.76	-1.64	5.36	0.72	0.54
3	I recognize and appreciate the intelligence of other living organisms	我承認並欣賞其他生物的智識	我承认并欣赏其他生物的智慧	4.17	0.64	-0.73	1.96	0.70	0.72
4*	I often feel disconnected from nature	我常常感到與大自然沒有連繫	我常常感到与大自然没有连系	4.27	0.81	-1.38	2.77	0.72	0.36
5	When I think of my life, I imagine myself to be part of a larger cyclical process of living	當我想及我的人生時，我想像自己是處於比個人更大的——個大自然生命週期	当我想及我的人生时，我想像自己是处于比我个人更大的一个大自然生命周期	3.74	0.82	-0.41	0.48	0.72	0.47
6	I often feel a kinship with animals and plants	我常常感到與動物植物有親近的關係	我常常感到与动植物有亲近的关系	3.87	0.74	-1.06	2.56	0.71	0.46
7	I feel as though I belong to the Earth as equally as it belongs to me	我感到我是屬於大自然的，就等於大自然是屬於我的	我感到我是属于大自然的，就等于大自然是属于我的	3.43	1.04	-0.42	-0.52	0.76	0.16
8	I have a deep understanding of how my actions affect the natural world	我深刻地理解我的行為如何影響大自然	我深刻地理解我的行为如何影响大自然	3.94	0.66	-0.69	1.41	0.71	0.51
9	I often feel part of the web of life	我常常感到自己是生命網絡的一份子	我常常感到自己是生命网络的一份子	4.07	0.53	0.07	0.58	0.70	0.77
10	I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	我感到所有棲息在地球的人類和其他生物都分享著共同的生命力量	我感到所有栖息在地球的人类和其他生物都分享着共同的生命力量	4.15	0.57	0.01	-0.05	0.70	0.85
11	Like a tree can be part of a forest, I feel embedded within the broader natural world	就像一棵樹是森林的一員，我感到自己是大自然的一員	就像一棵树是森林的一员，我感到自己已是大自然的一员	4.24	0.55	0.06	-0.26	0.71	0.78
12*	When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature	當我考慮我在地球的位置時，我認為自己是大自然階梯頂層的一員	当我考虑我在地球的位置时，我认为自己是大自然阶梯顶层的一员	2.86	1.05	0.29	-0.57	0.79	-0.15
13	I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees	我常常感到我只是大自然的一小部份，而我不比地上的草或樹上的鳥更重要	我常常感到我只是大自然的一小部份，而我不比地上的草或树上的鸟更重要	3.58	0.84	-0.46	-0.36	0.74	0.26
14*	My personal welfare is independent of the welfare of the natural world	我個人的福祉與大自然的福祉是各自獨立的	我个人的福祉与大自然的福祉是各自独立的	3.76	0.90	-0.93	0.61	0.74	0.28

Note: Items marked with * were reverse-scored; ^aStandard error asymmetry = 0.15; ^bStandard error kurtosis = 0.44; ^cForced extraction of a single factor (test of goodness-of-fit: $\chi^2 = 140.45$; $df = 77$, $p < 0.00$, $\chi^2/df = 1.82$).

We subsequently converted our Chinese CNS from Traditional Chinese script (used in Hong Kong, Macau and Taiwan) to Simplified Chinese script (used in Mainland China) and administered it to 84 TCM practitioners across China's Guangdong province. This sample was almost entirely monolingual (although split between Cantonese and Putonghua as primary dialect—54 Cantonese, 16 Putonghua, Cantonese and Putonghua 12, Bilingual Chinese and English 2). This sample was also male dominant (64 male, 24 female), with an average age of 46. The scale maintained good internal consistency reliability (Cronbach's $\alpha = 0.74$). We conducted an exploratory factor analysis using the maximum likelihood method (Mayer & Frantz, 2004; Navarro et al., 2017). As with the original instrument, we found one predominant factor: the first factor had an eigenvalue of 4.69, which fell to 1.82 for the second and 1.30 for the third. Extracting a single factor explained 29.2% of variance (KMO = 0.79; $p < 0.00001$), with items 7, 12, 13 and 14 having factor loadings below 0.3 (Table 2; see Appendix B in Supporting Information for details of the statistical analyses).

As both of our samples were medical professionals and were relatively small, further piloting and psychometric testing will confirm whether our adaptation can be used broadly with Chinese speakers beyond medical professionals. While our translation was done in Modern Written Chinese (the standard form of the written language comprehensible by literate Chinese speakers regardless of primary dialect), our choice to use different locations for pilot testing and data collection may have introduced error. Further testing will also confirm whether the elimination or down-weighting of items with poor factor loadings is appropriate as per translations of the CNS into other languages (Maccallum, Widaman, Zhang, & Hong, 1999; Navarro et al., 2017; Olivos et al., 2011; Pasca, Aragonés, & Coello, 2017).

3 | CONCLUSIONS

Social research in ecology and conservation often rely on study instruments that were developed in a different language and cultural context to the one in which they are being applied. Instruments adapted for cross-cultural research must maintain equivalency, as poorly translated instruments can produce erroneous results and invalidate conclusions. No translation method is perfect, and there is no fail-safe method to ensure that translations maintain equivalence. Methodological rigour and careful planning—which takes time and resources—can improve the confidence that researchers have in their adapted instruments (Sousa & Rojjanasrirat, 2011; Sperber, 2004). Researchers must take into account their particular circumstances and the resources available to them to determine what procedures are appropriate for their purposes (Brislin, 1970; da Mota Falcão et al., 2003).

In this paper, we outlined an easy-to-use method to translate study instruments. This five-step procedure requires a team of translators with balanced expertise to carry out forward and back-translations, using a committee approach to find the best possible translation for

pilot testing. To demonstrate how this works, we adapted the 'connectedness to nature' scale from English into Chinese. In doing so, we were able to observe the benefits of having a team of translators work collaboratively, as opposed to relying on a single translator's abilities. Having multiple forward and back-translations allowed us to produce a translated instrument that drew from the collective abilities of our team. While this required more time and resources relative to direct forward translation, we believe that this method can help ecologists and conservationists better maintain equivalency when translating study instruments for cross-cultural research.

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AUTHORS' CONTRIBUTIONS

H.C., L.M., H.P.P. and D.B. conceived the ideas and designed methodology; H.C. coordinated translations, collected the data and led the writing of the manuscript; K.-P.T. contributed to the translation process; H.C., L.M. and K.-P.T. analysed the data. All authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

Data available from the University of Queensland's institutional repository, UQ eSpace, at <https://doi.org/10.14264/uql.2020.391> (Cheung, Possingham, Mazerolle, & Biggs, 2020).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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