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ORIGINAL ARTICLE

Benchmarking the Quality of Chinese to English Geotourism Interpretation: the SSC Model Based on Eco-translatology

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Abstract

The global growth of geotourism has increased the demand and quality for geotourism interpretation. However, in its pioneer stage, geotourism interpretation has much ineffective interpretation, which hinders the informative purpose of geotourism. Moreover, geotourism interpretation lacks a systematic quality evaluation model. Such a model is essential to the future of reliable interpretation and the minimising of ineffective interpretation. This paper exams whether the currently proposed SSC model (Semantic, Style and Cultural Equivalence) for translation benchmarking purposes can effectively ensure the quality of geotourism interpretation. The SSC model is built on the three geotourism categories (ABC-Abiotic, Biotic and Culture), the unique principles of geotourism interpretation (which are determined by its objectives) and the theory of Eco-translatology. To enhance corpus research, the digital auxiliary tools, Tmxmall (2014) and Sketch Engine (2003), were used. The detailed SSC model was shaped through corpus-based contrastive analysis. The model contains a total of eight criteria that the interpreter should follow, including four for semantic equivalence: linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of geo-information; and three for style equivalence: logical syntax, concise syntax and appropriate voice syntax. The final criterion is an accurate connotation in cultural elements. The main research findings were that the SSC model can minimise ineffective interpretation of Chinese to English geodata and guarantee accurate transmission of data for geotourism in Chinese UNESCO Global Geoparks.

Keywords SSC model · Geotourism interpretation · Corpus-based contrastive analysis · Benchmarking quality · Eco-translatology

Introduction

Geotourism is variously described but has been aptly defined by its emphasis on the learning and engagement of the tourist (Geological Society of Australia 2015; Newsome and Dowling 2018; Dowling 2021). Hence, effective interpretation of geotourism data is the foundation (Dowling 2013) to provide accurate information to help geotourists respond to the environment intelligently and appropriately. In the earliest years of geotourism, there was a lack of data classification. To facilitate clarity, Dowling (2013) introduces three categories of all geotourism data: Abiotic, Biotic and Cultural (ABC). The abiotic (A), element (AE), mainly refers to geological features (GFs) and geological processes (GPs). Biotic (B), element (BE), involves the interpretation of flora and fauna while cultural (C), element (CE), relates to the interpretation of people's culture and lifestyle, past and present. Moreover, there is often a close and sometimes complex relationship between the elements (Dowling 2013). This author also claims AEs (GFs and GPs) are the most important part of geotourism because the AEs are the foundation for the survival of the BEs (flora and fauna) and significantly, the CEs are embedded in the AEs. For the purposes of this paper, geoparks will be used for data as most geotourism activities are practiced within them. The ABC system will also be employed because it is the most effective way of elucidating the interpretation of data in geoparks, as was found by recent studies (Pásková et al. 2021; Li et al. 2022).

Many interpretation challenges are embedded in interpreting ABC elements in Chinese UNESCO Global Geoparks

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(UGGps). These elements are located in various places, namely, signage in geomuseums, visitor centres, walking trails, or reserves. The difficulty within AEs will be analysed first. GFs or GPs of AEs contain much scientific geological knowledge and terminology which are difficult to understand. As well, often for reasons which will be explained, the AEs may be difficult to interpret from Chinese to English (C-E) because of a lack of equivalence. For example, unique cultural colour terms, such as '丹' and '碧' as well as specific Chinese cultural words such as '独秀' in '独秀峰'. Apart from scientific jargon and lack of direct equivalence, the dissimilarity of the two linguistic patterns presents obstacles. For example, the AEs in the Chinese GPs involve long and complex processes that are difficult to satisfactorily interpret into the English language structure. The challenge of BEs will be examined second. The challenge here mostly comes in interpreting Latin names of plants and animals, which, for the geotourist, are academic, hard to pronounce and remember. Another BE challenge is associated with the many local Chinese names for different flora and fauna such as '红果草' and '飞鼠'. Interpreters may lack the ecological cultural background to interpret these local names accurately. BEs also have the structural differences between Chinese and English languages causing obstacles when (1) interpreting the formation process of geological features by some primitive animals or plants; or when (2) interpreting complex processes such as features and inhabitants of plants and animals. Similarly, it is difficult to effectively interpret the CEs in geotourism. The religious, artistic or historical Chinese lifestyle may be unknown to the geotourists, such as '文房四宝' and '大篆'. More specific examples about ABC interpretations will be discussed in the 'Results and Discussion' section. In sum, there are many challenges in interpreting A, B, and C geotourism elements from C-E. The nature of these challenges has been outlined but can be summarised as linguistic, communicative and cultural. Thus, this paper will focus on finding a model of semantic, style and cultural equivalence (SSC equivalence).

Even after the application of Dowling's (2013) ABC categorisation, there is still a somewhat haphazard approach to interpretation strategies, due to there being no systematic theoretical framework for interpreters. This lack of guidance has led to inconsistency and some confusion in data output. To ameliorate the current interpretative situation, this paper will explore an SSC model based on a complex theoretical framework, partly including Eco-translatology (2001). This theory combined with the principles of geotourism interpretation, and the ABC system will be used as the theoretical guidance system and using corpus research will build the model. This SSC model aims to benchmark the quality of C-E geotourism interpretation in Chinese UGGps. Mixed research methodologies, which are field research and corpus-based contrastive analysis, are used in this research. In this manner, the main difficulties of C-E geotourism interpretation will be explored according to the targeted research question below. (Some linguistics terms will be explained in the Appendix Table 1)

Literature Review

When considering the SSC model, it is helpful to first consider several previous models for benchmarking translation. For example, House's translation quality assessment (TQA) (2015) is used to evaluate translation quality in various related genres. As well, the customised model of NER (originally the NERD model, cf. Romero-Fresco and Pérez 2015) is applied for evaluating the translation quality of intralingual subtitling while NTR (Romero-Fresco and Pöchhacker 2018) and FAR (Pederson 2017) are tailored to assess the translation quality of interlingual subtitling. Furthermore, Huang's (2020) model can be employed to test translation quality of traditional Chinese medicine (TCM). For the deeper purposes of the current paper on geotourism interpretation and translation, House's TQA model (2015), Pederson's FAR model (2017) and Huang's TCM model (2020) will be discussed.

House's TQA model (1977) is considered the most methodical model for quality assessment (Munday 2016) and has been widely applied. House (1977) revises her original TQA model in 1997, and again recently in 2015 when basing it on the Hallidayan (1985) functional system of register (field, tenor and mode) and applying it to a comparative English–German corpus analysis of 52 children's books. Over the forty years of TQA's complex development, it has been effectively applied to a wide variety of genres, confirming its reliability. For example, Jiang (2010) uses TQA to evaluate the translation quality of museum texts. The following year, *The Lord of the Rings* translation from English to Swedish was examined through TQA by Gehrmann (2011). After their own translation revisions, Faghih and Jaza'ei (2015), as well as Al-haddad (2015), tested the translation quality of their resultant poetry and literary texts. Varmazyari and Anari (2016) apply House's (2015) revised TQA model to test Sari Aslani's Persian translation of Chomsky's *Media Control.* Their results show the target text (TT) fails to make full sense of the meaning of the source text (ST). Also, using the House (2015) TQA, Sharif and Abadi (2017) find it effective in evaluating the quality of medical translation; as does, Hedayati and Yazdani (2020) are selecting religious and political texts, concluding that the House (2015) model is successful. Therefore, TQA (2015) has been well tested.

Some other frameworks are notable for evaluating the quality of translation. The FAR model evaluates quality in interlingual subtitling. The inventor of this model, Pedersen (2017), states the model was constructed by combining existing

models, empirical data, best practice, and new eye-tracking studies. It was then tested by him on Swedish fansubs (subtitles made by fans for fans) based on corpus quantitative analysis. This model was proposed from three aspects: Functional equivalence (do the subtitles convey the speaker's meaning?); Acceptability (do the subtitles sound correct and natural in the target language?), and Readability (can the subtitles be read in a fluent and non-intrusive way?). In later research, Pederson (2019) selects 16 subtitled versions of 10 movies in the English language as corpus to continue to test the Swedish translation quality via FAR model and also investigate creativity. The findings indicate that there is considerable variation among the various fansub versions. Fansubbers are generally determined to be more informal, less adherent to norms, and also more inclusive of abusive language in the original script than professional subtitlers in Sweden. Other translation researchers, Abdelaal (2019) and Alexander (2020) use the FAR model. Abdelaal (2019) takes the American film, *American Pie* to test the quality and explore strategies of cultural bound terms from English to Arabic while Alexander (2020) uses a courtroom drama, *Suits* (first session), to exam the quality and develop strategies of Extralinguistic Cultural References from English to Dutch. They both use Pedersen's (2005, 2011) typology and FAR model (2017) for qualitative analysis. The results show that direct translation is the most frequently used strategy and most of the range of strategies proposed by Pedersen are adopted. In addition, Abdelaal (2019) proposes two new subtitle strategies, namely, using euphemism, and using formal language similarly, Alexander (2020) makes some specific recommendations for future legal subtitlers. In a contrast model, Huang's (2020) study is guided by Skopos Theory and can be compared with Li's (1997) TCM terminology translation. Huang (2020) proposes a reader-centred TCM terminology evaluation. However, because Skopos Theory is always concerned with the function of the target language (TL), it cannot be regarded as a complete model or an adequate comprehensive theory for bidirectional translation evaluation.

In regard to the literature on geotourism interpretation itself, firstly, there are general limitations of quantity and scope. Initially, Dowling (2013) coined the ABC system to study geotourism interpretation which has been widely used by scholars. For example, Ren et al. (2014) compare the interpretation in Chinese geoparks and the American National Parks through a case study. They provide an interpretation model for geoheritage, from the perspective of communication, to aid the layperson in comprehending geoscience knowledge. This study does not evaluate the C-E geotourism interpretation, however. In more recent research, Gulas et al. (2019), Pásková et al. (2021), Li et al. (2022) and Newsome et al. (2021) apply ABC. Gulas et al. (2019) conduct research on Styrian Eisenwurzen, an Austrian UGGp. The authors' goal is to engage local citizens in the protection of the region's geoheritage and natural resources, while also increasing the region's exposure and tourism appeal. They suggest that by improving data exchange, the ABC interpretative idea can benefit both landscape conservation and geoheritage. Pásková et al. (2021) compare two UGGps, the Colca canyon and volcanoes in Andagua (Peru), and Muroto (Japan). They find that the Muroto Geopark interpretation demonstrates a high level of visible ABC application, but the Andagua Geopark interpretation lacks local people's cultural knowledge to inform their Earth heritage interpretation. More significantly for evaluation of interpretation, Li et al. (2022) shape a taxonomy of interpretation strategies in A and C based on quantitative and qualitative analysis of data in Yandangshan UGGp and Danxiashan UGGp. Finally, in geotourism interpretation, Newsome et al. (2021) confronted gaps in research by using ABC to interpret the regolith of southwest Australia. In fact, the difficulty of scientific jargon presented an obstacle to interest in regolith. The innovation of this research was to simplify the scientific terminology to show the current significance of regolith to geotourists.

In conclusion, through review of relevant literature, it can be seen that although the ABC system has brought a measure of organisation to geotourism, specifically there is not yet a systematic model proposed to guide and evaluate the quality of interpreting geotourism texts from C-E. As was seen from the literature review, the inspiration for this type of research modelling has come from the TQA pioneers and precedents: that is, House (2015), Pedersen's FAR Model (2017), and to some extent, Huang's (2020) TCM translation model based on Skopos Theory. In order to research the lack of a benchmarking geotourism model, firstly, data was collected from Taishan UGGp and Leiqiong UGGp for the research corpus. The quality of interpretation of all the collected data will be categorised, analysed and guided by the theoretical framework of Hu's Eco-translatology combined with principles of geotourism interpretation. Finally, the benchmarking quality model of C-E interpretation will be generated from three parameters: semantic, style, and cultural equivalence based on Hu's Eco-translatology. The researcher is indebted to previous models and research, particularly by House (2015) and Pedersen (2017), in identifying the challenges in geotourism interpretation. Therefore, the targeted research question can be proposed as based on the following research gap of TQA in geotourism:

Is the SSC Model, Based on Eco-translatology Combined with Principles of Geotourism Interpretation, Sufficient to Effectively Guarantee A Quality Geotourism Interpretation and Translation of Data?

This research question directs contributions to two fields: linguistics and geotourism, specifically benchmarking quality of C-E geotourism interpretation and corpus-based geotourism interpretation and translation studies. Firstly, it is hoped that this model will provide a pioneer standard for assessing the quality of geotourism interpretation and

translation. For instance, the field of geotourism interpretation will be provided with its own interpretation and translation quality assessment model and a theoretical basis for the development of geotourism translation in the future. Secondly, this model will facilitate the growth of corpus-based geotourism translation. For example, geotourism translation researchers can use this model which provides the basis for tagging data in parallel geotourism corpus (PGC). Besides, effective interpretation can educate geotourists through interpreters, and finally achieve the purpose of geotourism: (1) better understanding and appreciation of our Earth; (2) Conservation, more specifically geoconservation; and (3) increased quality of livelihood for local communities.

Register and Principles of C-E Geotourism Interpretation

One of the fundamental principles of geotourism is the need for simple communication for the geotourist audience (Newsome et al., 2021). This means the benchmarking SSC model for translation needs to align with this. This paper is the first suggestion for a systematic approach to aligning translation with the principles of C-E geotourism interpretation. It can be done by using the framework of register theory, an idea proposed by Halliday (1985). In his innovative research, Halliday (1985) defined register and the three variables of register. He used the term, 'register', to encompass the whole vocabulary signature of a field, as well as to describe the functional unit of a specific discourse. Therefore, in its latter and specific application, it can label the quality or tenor of a discourse. These are the three variables of register: field, mode and tenor.

In aligning the principles of geotourism with Register Theory, field can be identified as ABC, abiotic (GFs and GPs) and biotic (fauna and flora) elements as well as cultural elements (history, culture, and local features of community). This means the field of geotourism includes a great deal of information, such as scientific jargon and complex geological processes.

The second category for the register theory is mode, which for this paper, is written mode (not spoken). Data is written either on brochures, leaflets, interpretive panels, signs, display boards, or geomuseum exhibits in Chinese UGGps. Mode also includes linguistic stylistic features. The written sentences in the ST (Chinese) of geotourism discourse can be long and complex because of Chinese syntax contrasted to the TT (English). Mode also includes cultural context. Therefore, translators may need to supplement with contextual information.

The third aspect of text is tenor which relates to the level of formality (Halliday 1985; O'Donnell 2021). Interpreters and geotourists are not closely related, therefore geotourism discourse is formal which is reflected at the lexical and syntactic level. Formal lexicon means there are many flowery adjectives, much scientific jargon, and rare use of first and second personal pronouns. Formal syntax may also mean long and complex sentences in the ST. Furthermore, in Chinese, more passive sentences are used to interpret complicated GPs while more active voice sentences to interpret complex flora and fauna. These variables of Register theory highlight the challenges presented by data interpretation and can be used to systematically address the challenges of translation in accordance with the principles of geotourism.

These principles of geotourism C-E interpretation based on Register Theory are summarised as below in Fig. 1. It is intended that the results of geotourism data analysis using these variables and aligning with the principles of geotourism will deliver an SSC model which can be used for assessing geotourism interpretation. Therefore, this is a model of translating interpretation from C-E, not a general model.

Theoretical Framework

Basic Concepts of Eco-translatology

To allow the translator to be guided by appropriate strategies, the principles of geotourism themselves are not enough. A wider approach to translation is needed and this is accommodated by Hu's (2001) Eco-translatology. Hu (2001) defines his key term, Eco-translatology as '"the translator's selection activity to adapt to the translational eco-environment", and advocates the concept of "translator-centredness"'. Hu (2003) describes the translational eco-environment as 'the worlds of the ST and the source and target languages, comprising the linguistic, communicative, cultural, and social aspects of translating, as well as the author, client, and readers.' Therefore, translation is 'a selection activity of the translator's adaptation to fit the translational eco-environment' (Hu 2003).

For the purposes of explaining his theory, Hu (2001) embraces many Darwinian terms. Hu (2003) advises that translators should not only learn to 'adapt', but also do their best to 'select'. Specifically, the characteristics of selective adaptation and adaptive selection are (Hu 2003): (1) translators' adaptation to the ST of translational eco-environment, and (2) translators in the central position to select the TT. However, Hu (2003) emphasised that although the translator is in the central position, it does not mean that he can manipulate the source language (SL) and the TL at will because he is constrained by the principles of translation effectiveness. The fundamental principles of adaptation and selection, like Darwin's (1859) biological theory, are survival of the fittest or best adaption. The translator forms a close internal relationship in the continuous alternating cycle of selective adaptation and adaptive selection

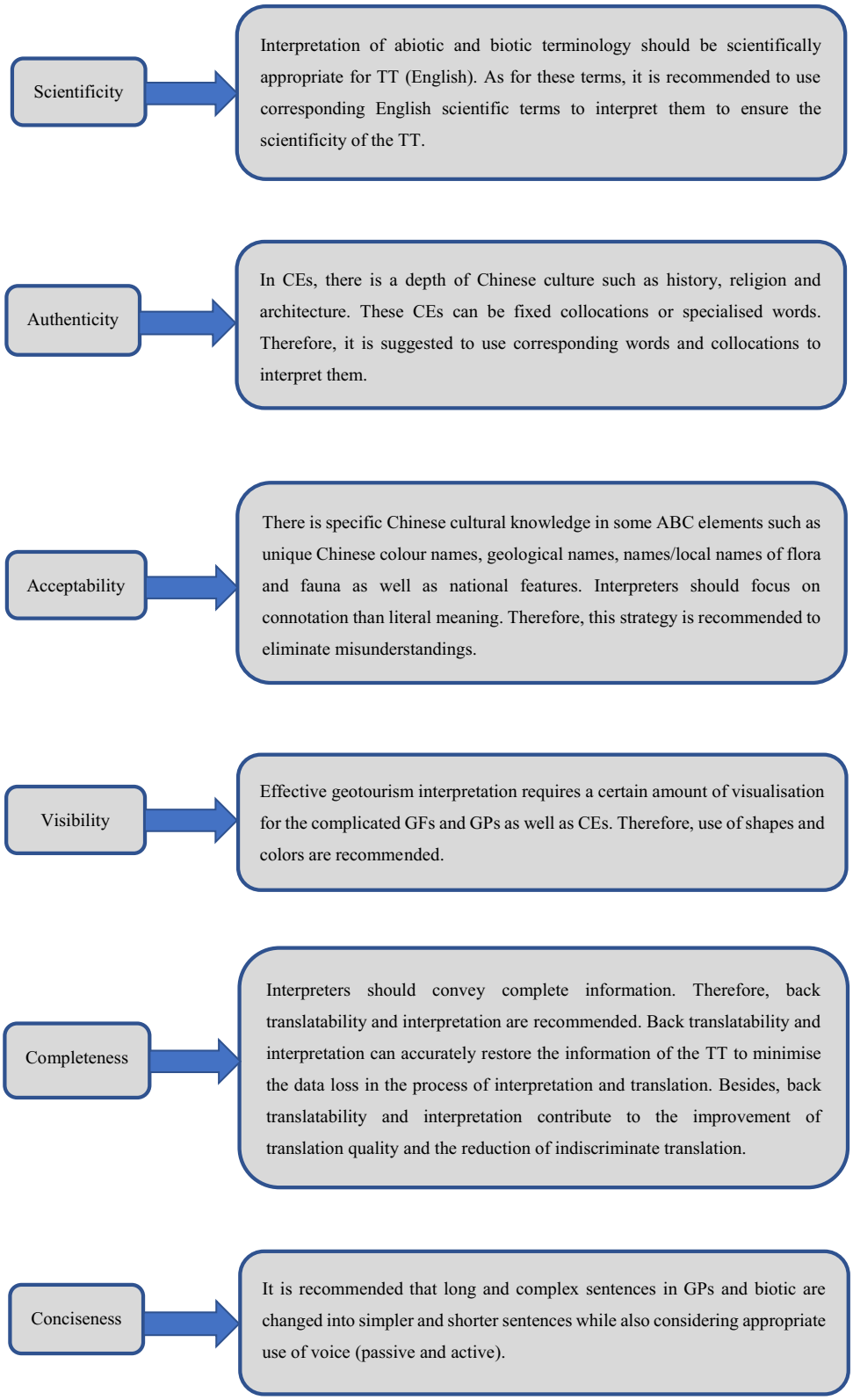

Fig. 1 Principles of geotourism interpretation

to optimise selection. This process of activity can be demonstrated by the diagram (Fig. 2).

Hu (2003) claims that translation is realised through multiple dimensions. Hu (2008) calls them the three key dimensions of translation (linguistic, cultural and communicative dimensions). It is the three dimensions that form the basic method of Eco-translatology by adaptation and adaptive selection.

Geotourism Translation and Eco-translatology

Eco-translatology fully considers the SL and the TL, as mentioned above in the 'Basic Concepts of Eco-translatology' section. Other theories, such as Skopos theory, pay more attention to the TL readers and therefore may miss important details and nuances of meaning in the SL.

Eco-translatology and geotourism translation are interdisciplinary researches that share the ecological level. Dowling (2013) notes ecotourism's formative relationship with geotourism. This means ecotourism translation has deep interconnections with geotourism translation and scholarship is intertwined in theory and application.

Another reason for the suitability of Eco-translatology as a foundational framework is the goal of geotourism translation (adaption and selection) matches Eco-translatology's. An example of the shared goal and application of Eco-translatology (adaption and selection) can be seen in geotourism's GFs. Because GFs contain much geological jargon, hence wrong interpretation strategies: such as using Chinese Pinyin to Replace English Word (UCPREW), Mistranslated, Not Translated (NT), and Incongruent Translation for Same Name (ITSN), may be used which result in semantic inequivalence — Hu's linguistic and communicative dimension (2003). Besides, there are many cultural terms embedded in GFs or GPs such as Chinese colour terms and specific Chinese cultural words, in which case, imprecise strategies may cause cultural inequivalence — Hu's linguistics, cultural and communicative dimension (2003). As well, style inequivalence — Hu's (2003) linguistic and communicative dimension can occur during the process of interpreting GPs from C-E. This is because Chinese language style tends to paratactic while English is hypotactic. Overall, accurate interpretation needs to be transformed by using Hu's three dimensions (language, culture and communication). A model (SSC) can be formed using this theoretical framework of Eco-translatology together with the tool of Register Theory applied to the principles of geotourism. Detailed information for this model will be analysed and discussed in the 'Results and Discussion' section.

Corpus and Methodology

Data Collection Procedure

Fieldwork was used to collect the data from Chinese UNESCO-recognised Global Geoparks, the most appropriate place for Chinese geotourism interpretation. They are the high-quality Chinese geotourism destinations because geology and geomorphology are their cornerstone. Specifically, Taishan UGGp, and Leiqiong UGGp were selected as a case study to test in this research. Data examples clearly illustrate the interpretation issues that most Chinese geoparks are currently facing. It should be noted, as there have been several stages of development in interpretation of data in various parks, that there is an inconsistent standard throughout these collected examples. Data research sources include brochures, leaflets, interpretive panels, signs, display boards, and museum exhibits distributed freely particularly at entrances, visitor centres, and museums. To avoid selection bias, it was necessary to limit data collection to easily accessible public sources, due to the potentially high number of translation issues. The following diagram (Fig. 3) illustrates a succession of procedures.

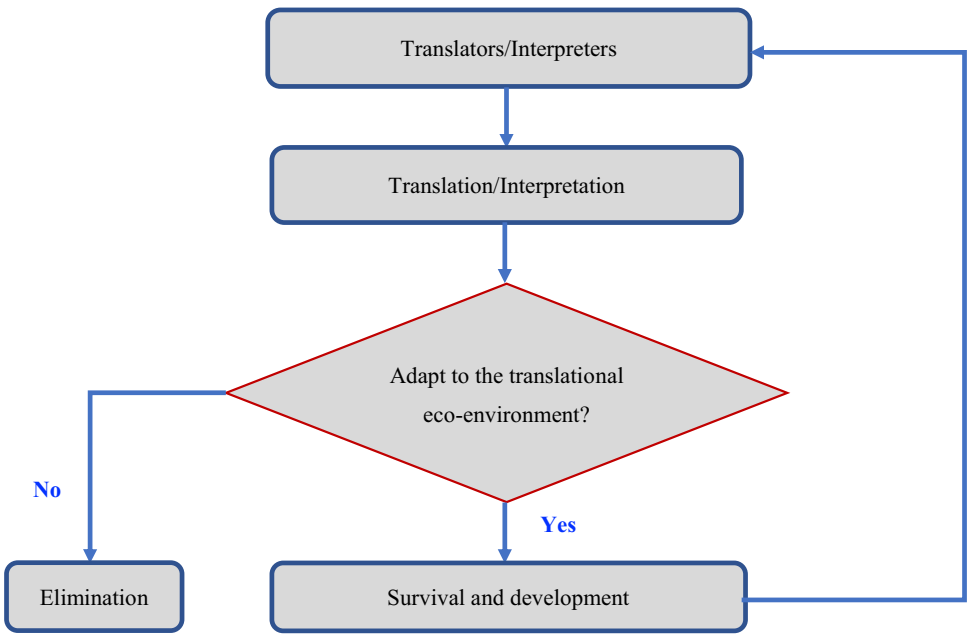

Fig. 2 'Adaptation/selection' of translation activity (Hu 2003)

The annotated categories of the above diagram were demonstrated in the below table (Fig. 4).

Corpus Procedure

After building the concordance (PGC), corpus linguistics (corpus-based) research methodology was applied. Li (2020) points out three advantages of corpus-based method. Firstly, it can process fast, accurate and complex analysis by computer. Secondly, the corpus has a large scale, including a comprehensive register, so a large amount of text can be used and a wide range of language information can be gathered. Finally, this method has both quantitative and qualitative functions, so the results and the description of language are comprehensive. In this paper, corpus-based contrastive analysis was applied in three categories (ABC elements) based on this PGC. Taking C element as an example of the contrastive analysis, the specific retrieval operation steps are as follows: (1) click the Parallel Concordance at DASHBORD page; (2) click the ADVANCE at the PARALLEL CONCORDANCE page; (3) choose English in 'Search in' and then click CQL Query type. Then, follow the function formula as below:

Search in
English
Query type
CQL
CQL
[word = "CE"] [word = ","] [word = "PL"] [word = ","] [word = "PT"]
or
[word = "CE"] [word = "[[:punct:]]"] [word = "PL"]
[word = "[[:punct:]]"] [word = "PT"]
Default attribute: word
Subcorpus: non (the whole corpus)

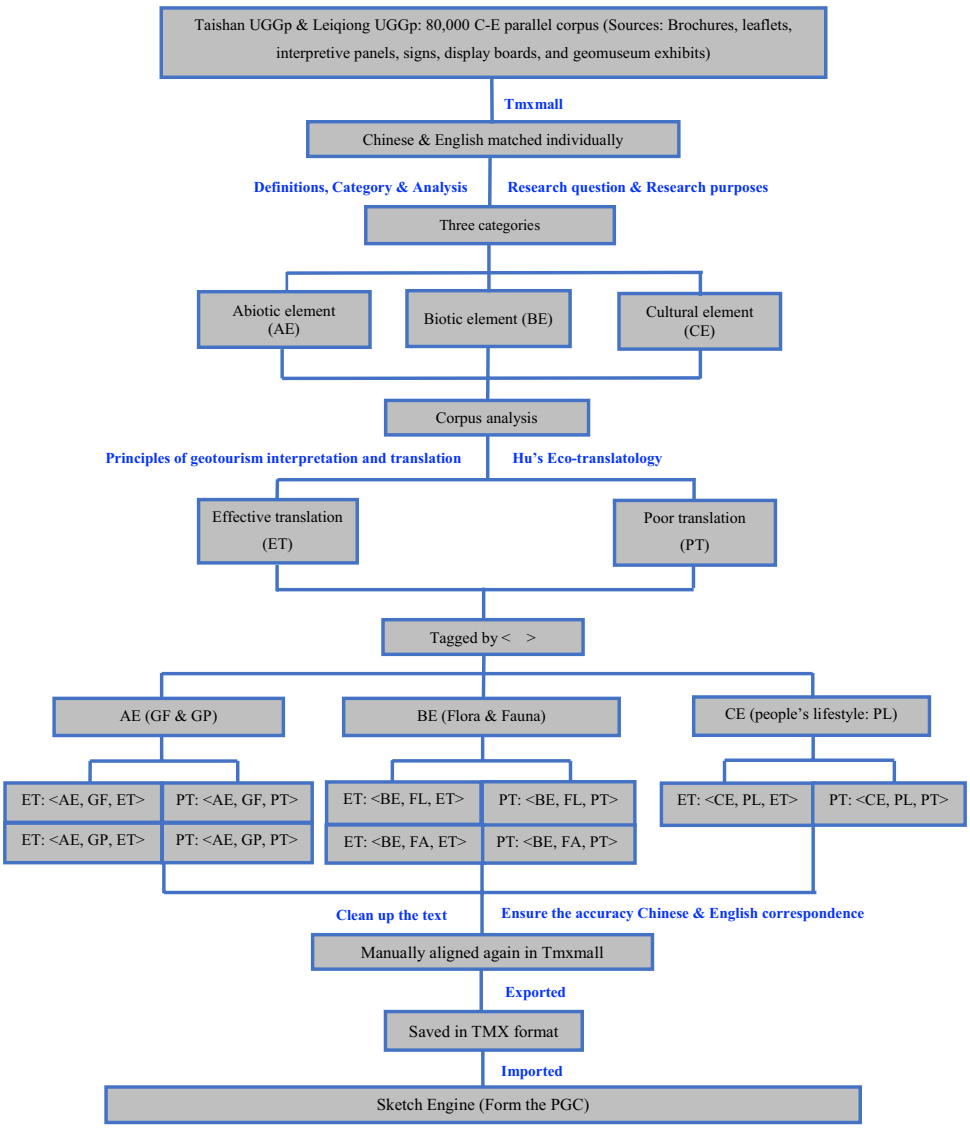

Fig. 3 Diagram of data processing

Fig. 4 Specific annotated comments

Annotated categories	Tag
Abiotic element	AE
Biotic element	BE
Cultural element	CE
Effective translation	EF
Poor translation	PT
Geological features	GF
Geological processes	GP
Flora	FL
Fauna	FA
People's lifestyle	PL

The specific examples of poor interpretations in semantic, style and cultural inequivalence in C element were selected respectively through the above process. These poor interpretations cannot conform Eco-translatology combined principles of geotourism interpretation. After identifying poor translations, the specific examples of effective interpretations in semantic, style and cultural equivalence in C element were also chosen respectively. These effective interpretations were also identified by Eco-translatology combined with principles of geotourism interpretation. Therefore, an example of the function formula of effective translations of the C element can be depicted below as:

Search in
English
Query type
CQL
CQL
[word = "CE"] [word = ","] [word = "PL"] [word = ","] [word = "ET"]
or
[word = "CE"] [word = "[[:punct:]]"] [word = "PL"]
[word = "[[:punct:]]"] [word = "ET"]
Default attribute: word
Subcorpus: non (the whole corpus)

Poor interpretations were contrasted with effective interpretations which were determined using semantic, style and cultural equivalence. Poor translations of C element in semantic, style and cultural inequivalence can be optimised with reference to effective interpretations to achieve semantic, style and cultural equivalence. A (GFs and GPs) and B (Fauna and Flora) elements can also be optimised by repeating the above analysis procedure. In this paper, 58 examples of ineffective and ineffective interpretations of ABC were selected for contrastive analysis from Data 1 to Data 11 in the Supplementary information.

Results and Discussion

Abiotic Element in GFs and GPs According to the SSC Model

The function formulas [word = "AE"] [word = ","] [word = "GF"] [word = ","] [word = "PT"] and [word = "AE"] [word = ","] [word = "GF"] [word = ","] [word = "ET"] were used to retrieve poor and effective interpretations of GFs in semantic level respectively. All the results are shown in the Data 1 (text 1–6). As can be seen from the Data 1 (text 1–3), inaccurate interpretation strategies that cause the semantic inequivalence of interpretation in GFs are ITSN, Mistranslated, and NT in GFs. These poor interpretations should be optimised with reference to effective interpretations (Data 1: text 4–6) which were identified by Eco-translatology combined with principles of geotourism interpretation.

Firstly, ITSN can cause semantic inequivalence in interpreting GFs. Results in the PGC show, '马鞍岭' (text 1) occurs 39 times, but there are four different interpretations: Mt. Ma'anling, Ma'anling Volcano, Ma'anling Mountain, and

Saddle Ridge Volcano. By contrast, '扇子崖' (text 4) occurs 21 times in the PGC which were only interpreted as 'Fan Cliff'. This is an effective version, because this interpreter fully considers the connotation of text 4, that it is in the shape of text 4, a fan. This version empowers geotourists to imagine, visualise and understand the complicated GF. Meanwhile, this version achieves transformation of linguistic and communicative dimensions and further semantic equivalence. Compared with this interpretation, text 1 was interpreted as 'Mt. Ma'anling' and 'Ma'anling Mountain' which fail to succeed as interpretation in the linguistic aspect or dimension, because the interpreter does not accurately understand the ST. Text 1 is a GF (volcano) which was formed by volcanic eruption. Besides, most geologists define a mountain as 'A landform which rises at least 1000 feet (300 m) above its surrounding area' (National Geographic 2022). Because the highest peak of '马鞍岭' only reaches 222.6 m, 'mountain' or 'Mt' cannot technically be used but 'volcano' would be appropriate in the final interpretation. Because '马鞍岭' looks like a saddle, with the reference to the interpretation of text 4, it can be interpreted into 'Saddle Ridge Volcano' to achieve semantic equivalence.

Another factor that can result in the semantic inequivalence of interpretation in GFs is Mistranslated. '云母鱼' (text 2) was interpreted into 'Biotite Fish Texture' which was a misinterpretation. By contrast, the accurate and scientific expression 'Vesicular Basalt' can be directly found in English to interpret '多孔状玄武岩' (text 5). Therefore, it easily achieves semantic equivalence and transformation of linguistic and communicative dimensions. Although'云母鱼' (text 2) was interpreted into 'Biotite Fish Texture' to relate to the shininess of fish, 'biotite' is an obscure term. This opinion was supported by Grotenhuis et al. (2003) who explain that biotite is a type of mica. So, when talking about biotite, 'mica' is a more commonly recognised and suitable term. Therefore, text 2 should be interpreted into 'Mica Fish' for the geotourist. This fulfils the scientificity and the principles of geotourism for interpretation.

NT can also cause semantic inequivalence of interpretation in GFs. '玄武岩上的圆形空洞' (text 3) was ineffectively interpreted into 'Holes on Basalt'. This interpreter ignored the significant pattern of the shape of the hole in the rock which is also contained in the ST. Based on principles of geotourism interpretation, interpreters should transfer the detail of GF with integrity to geotourists and fully demonstrate the nature of the GF. The interpretation of text 3 can be changed into 'Round Holes on Basalt'. The shape (round) of this GF was supplemented to guarantee the completeness of the ST. However, '崩塌堆积 (仙人桥)' (text 6) better interprets detailed information of GFs. Text 6 was rendered into 'Talus: Colluvial Deposits (Immortal Bridge)'. This interpretation conveys the detailed information of the ST to geotourists. This empowers them to imagine a colluvial deposit of rock debris caught in motion.

Apart from semantic inequivalence, inaccurate GF interpretations can also generate cultural inequivalence. To obtain the data and category, the same function formulas [word = "AE"] [word = ","] [word = "GF"] [word = ","] [word = "PT"] and [word = "AE"] [word = ","] [word = "GF"] [word = ","] [word = "ET"] were used to search poor and effective interpretations in the PGC. The selected examples (Data 2: text 7–12) were used to make a contrastive analysis. As can be seen from the Data 2 (text 7–9), wrong interpretation strategies such as ITSN, Mistranslated, and UCPREW are the main elements causing the cultural inequivalence of interpretation in GFs. These inaccurate interpretations were also improved with reference to effective interpretations (Data 2: 10–12) identified by Eco-translatology combined with principles of geotourism interpretation.

Firstly, in terms of ITSN, there are cultural words embedded in some GFs which are sometimes but not always interpreted consistently. '彩石溪' (text 7) occurs 47 times, but three interpretations can be found in the PGC which are 'Choi Shek Brook', 'Caishixi Stream', and 'Colourful Stone Stream'. By contrast, '碧石岩' (text 10) appears 61 times in the PGC which were effectively interpreted into the same term, 'Green Rock'. In text 10, '碧' in Chinese can mean green or blue but according to the principles of geotourism interpretation, 'green' should be selected instead of 'blue', because 'green' can be observed from this GF. Therefore, '碧石岩' was interpreted into 'Green Rock' which matches the three-dimensional transformation of Eco-translatology and achieves cultural equivalence. This interpretation can give '彩石溪' the correct direction of revision. The Chinese colour character, '彩' , can be used to mean either chromatic or achromatic colour. The former can include red, orange, yellow, green, blue or purple while the latter refers to black, white or gray. The name '彩石溪' refers to the combination of the two different rock formations: the colourful Amphibolite with the river like belt of steel grey Arizonite. Therefore, '彩石溪' cannot be interpreted into 'Choi Shek Brook' and 'Caishixi Stream' as this is misleading and fails to demonstrate the meaning of the GF. These two versions do not adapt to geotourists' need, guided by the interpretation of '碧石岩' should, whereas 'Colourful Stone Stream' is an accurate version to interpret '彩石溪'. This version not only realises the three-dimensional transformations and cultural equivalence, but inspires the geotourists' wonder and appreciation of GFs.

Secondly, Chinese and Western cultures are embedded in the translation of some GF terms such as '龙' in text 8 and '圣婴' in text 11. The presence of cultural inequivalence means that direct translation can fail to realise the full dimension of successful interpretation. '黑龙潭' (text 8) was literally interpreted into 'Black Dragon Pool' which is Mistranslated. Text 8 can be improved with reference to '

龙' (dragon). Dragon is an auspicious symbol of Chinese culture while Westerners relate it to fantasy stories or traditions of evil. However, in the modern digital development of Western culture, there are also occasional hero dragons and notably baby dragons are recently loved by preteens. This means '龙' can be interpreted into 'dragon'. However, '黑龙' in text 8 was interpreted into 'Black Dragon' which would connote an evil force to Westerners. Therefore, such literal interpretation fails to fully consider the admiration in the original culture. In this case, '黑龙' can be regarded as Chinese cultural function characters which are rendered into 'Heilong' via transliteration. Because '潭' refers to the GP of pool formation and can simply be interpreted as 'pool', text 8 was optimised into 'Heilong Pool'. This version not only retains the SL culture, but also transmits the connotation of the SL. Text 11, '圣婴' contains a cross, one of the symbols of Christianity. However, the interpreter did not literally interpret it as 'the Christ Child' or 'Divine Infant', because in this context, two connected volcanoes are compared to '圣婴'. If it was interpreted into 'the Christ Child', this would make foreign geotourists mistakenly believe the local people were Christian. Therefore, '火山圣婴' (text 11) should be interpreted into 'Volcanic Twins' rather than 'the Christ Child Volcano'. The version of 'Volcanic Twins' allows geotourists to quickly imagine that the GF is two volcanoes and adapts to achieve cultural equivalence.

Besides the above examples, UCPREW causes cultural inequivalence of interpretation in GF. '虎阜石' (text 9) was inaccurately interpreted into 'Hufu Stone', while another GF, '永茂岭火山' (text 12) was accurately rendered into 'Yongmaoling Volcano'. These two GFs have one thing in common that they can be divided into two parts. In text 12, the former section '永茂岭' can be regarded as Chinese cultural function characters which just refer to a geographical place name, while the latter part '火山' is the GF. These two parts together constitute a GF. Li et al. (2022) state when it comes to interpreting the names of certain rocks, caverns, peaks, and waterfalls, direct translation cannot sometimes adequately convey their essence. In this case, the first section (culture function characters) can be represented using transliteration, whereas the second section can be directly rendered the GF. Thus, text 12 was scientifically interpreted into 'Yongmaoling Volcano'. Similar to text 12, in text 9, the former part '虎阜' are Chinese cultural terms and the latter section '石' is the GF. Unlike text 12, the shape can be observed from the former section of text 9 (relating to geotourism principle of visual importance of element's interpretation). Thus, the former part '虎阜' should be interpreted as 'Couching Tiger' rather than 'Hufu', because this particular GF can be seen very clearly as a crouching tiger. The latter part, '石', should be directly rendered into 'Stone'. Text 9 should be rendered into 'Crouching Tiger Stone'. This realises the transformation of Eco-translatology and cultural equivalence.

Similarly, the function formulae, [word = "AE"] [word = ","] [word = "GP"] [word = ","] [word = "PT"] and [word = "AE"] [word = ","] [word = "GP"] [word = ","] [word = "ET"], were used to retrieve poor and effective interpretations of GPs respectively in the PGC. The selected examples (Data 3: text 13–18) were analysed contrastively. As can be seen from Data 3, the interpretation of GPs mainly focuses on the lexical and syntactical level. At the lexical level, ITSN and Mistranslated lead to the semantic inequivalence of the GP. In text 13, '燕山运动' occurs 72 times in the PGC which were inconsistently interpreted into 'Mount Yan's Movement', 'Yanshan Movement', and 'Yanshanian Orogeny'. Text 13, 'Yanshanian Orogeny' is more accurate than the other two, and many geological researchers use this version in their articles, such as in Zhu et al. (2019) and Yang et al. (2020). Text 15 '地下岩浆' was ineffectively interpreted into 'underground lava'. In English, '岩浆' can be expressed as 'magma' or 'lava'. Oxford English Dictionary (2022) defines magma as very hot liquid rock found below the earth's surface while lava, as hot liquid rock coming out of a volcano. Thus, '岩浆' in text 18 was accurately translated into 'magma'. By contrast, '地下岩浆' and '岩浆' in text 15 were interpreted 'underground lava' and 'lava' which should be replaced by 'magma' according to the context. However, '球形风化' (text 16) appears 94 times in the PGC and were scientifically and accurately interpreted into 'Spheroidal Weathering', because this English phrase, is widely accepted by geologists.

At the syntactic level, firstly, NT causes the semantic inequivalence of GPs. In text 14, '或裂开, 从而形成断层' is not translated which cannot accurately recover information in the ST to geotourists. Thus, the omission of key information affects the transformation of linguistic and communicative dimensions and semantic equivalence. Therefore, the omitted information in text 14 should read 'When the stress load on the rock stratum exceeds its limit, the rock will fracture, partially or fully.' By contrast, in text 17, the complex formation of a mixed cone was effectively interpreted to geotourists in detail and completeness.

Furthermore, Mistranslated errors result in style inequivalence in interpreting complex GP. According to Huang and Ren (2020), the language styles of Chinese and English are very different. In Chinese style, complex long sentences can be used while in English, people usually use direct shorter sentences. Another relevant contrast is in the frequent use of passive in English to emphasise the nouns which carry the data. These two grammatical differences affect the accuracy of the interpretation of GPs from C-E. For example, in text 21, the formation process of the prototype of Mount Taishan was precisely interpreted from C-E. Firstly, '控制' and '形成' as implicit passive verbs were rendered into 'controlled by' and 'be formed' respectively. Meanwhile, '被风化和流

水侵蚀' as an explicit passive structure was interpreted into 'was gradually weathered and eroded by waves and currents'. Besides, one long and complicated sentence was divided into three short and simple sentences in the TT. This realises the transformation of linguistic and communicative dimensions and conforms to the English style. However, the interpretations of cooling process of basaltic magma (text 19) and orogenesis (text 20) were not interpreted well. In text 19, cooling process of basaltic magma was ineffectively interpreted to English geotourists, because this GP was interpreted into a long complex sentence and passive was interpreted as active. Therefore, ST 19 should be optimised into 'During the cooling of basaltic magma, numerous contractions are formed on the surface of the lava, resulting in fissures. The volume of magma shrinks as it cools forming a polyhedral column, mostly either, pentagonal or hexagonal.' In this interpretation, the implicit passive '形成' was interpreted as 'was formed' and a long complex sentence was divided into two short simple sentences. The process of orogenesis (text 20) was also inaccurately interpreted to target readers, because implicit passive structures '挤压' and '变形' were interpreted into active. Text 20 can be revised into 'Orogeny refers to earth movement when the crust is compressed and stressed so that rock is uplifted on a large scale to form mountains.' Note that passive voice was used in this version.

Biotic Element in Flora and Fauna According to the SSC Model

The function formulas [word = "BE"] [word = ","] [word = "FL"] [word = ","] [word = "PT"] and [word = "BE"] [word = ","] [word = "FL"] [word = ","] [word = "ET"] were employed to retrieve poor and effective interpretations of flora. These are the instances (Data 5: text 22–26) that were chosen for contrastive analysis. In data 5 (text 22–24), inaccurate strategies such as NT, UCPREW, ITSN and Mistranslated result in semantic inequivalence. Firstly, using inaccurate strategies ITSN and UCPREW to interpret names of flora causes semantic obstacles for geotourists. '海南黄花梨' (text 22) occurs 53 times in PGC while its interpretation occurs in four different versions: 'China Scented Rosewood', 'Yellow Ormosia', 'Yellow Rosewood' and '*Dalbergia odorifera T. Chen*'. Similarly, '蛤蒌' (text 23) occurs 42 times which was ineffectively interpreted as 'Halou' via UCPREW. Compared with these two inaccurate interpretations, '箭毒木 (见血封喉)' (text 25) appears 74 times which was consistently and scientifically interpreted into '*Antiaris toxicaria* Lesch. (Arrow Poison Wood) (Upas))'. According to principles of geotourism interpretation, names of flora should be scientific and commonly acceptable, therefore, using Latin and English together to interpret them will be more effective than using English or Latin alone. Latin scientific names should be in italics. 'Arrow Poison Wood' can direct correspond to text 25 in English. In this way, geotourists can understand what the specific plant is and achieve semantic equivalence. Meanwhile, this interpretation method finishes the transformation of language and therefore achieves the final goal of the interpretation: communication. This interpretation can guide interpreters to optimise the interpretations of text 22 and text 23. In English, 'China Scented Rosewood' and 'Wild Pepper Plants' can directly correspond to text 22 and text 23 respectively. Thus, text 22 can be interpreted into '*Dalbergia odorifera T.Chen* (China Scented Rosewood)' and text 23 is '*Piper sarmentosum* Roxb. (Wild Pepper Plants)' to achieve semantic equivalence. It is significant to note when a type of plant is interpreted alone on the interpretative panel, to comply with scientific and acceptable principles of geotourism interpretation, the plant name as the title on the interpretation board should be interpreted via Latin and English simultaneously. When this plant only appears in the interpretation content, to accord with principles of simplicity and conciseness of geotourism interpretation, only English is used. This rule also applies to the interpretation of animal names to be mentioned next.

Secondly, NT and Mistranslated can also cause semantic inequivalence in interpreting complex biotic processes. In text 24, the underlined sentence was not rendered, and '系明代嘉靖年间所植, 约三百年许, 被雷击倒' was misinterpreted when history and the particular feature of the Chinese Wolong Scholar tree were interpreted. By contrast, the complicated process of 'Pines of Han Dynasty (Two connected Pines)' (text 26) was effectively interpreted to geotourists, because accurate formal words and phrases were used in the TT to convey the complete information to geotourists. Thus, the TT 26 obeys linguistic and communicative transformation of Eco-translatology to achieve semantic equivalence. This interpretation provides a paradigm for successful interpretation of text 24. To achieve semantic equivalence, the omitted interpretation should be added, and the misinterpreted part should be revised. Thus, text 24 can be improved into 'the Chinese scholar's tree, Sophora, leguminous plant, defoliating arbor. There are altogether over eight metres between the north and the south trees. The tree has odd and vigorous limbs of primitive simplicity with twisted roots and an upward facing tree crown. The shape is just like a sleeping dragon raising his head high. After growing for about 300 years, the tree was struck by lightning and now grows horizontally. So, it now maintains a horizontal position with its stem taking root by touching down to the ground'. All significant detailed information is now interpreted completely and accurately.

In data 6 (text 27–29), Mistranslated causes style inequivalence when complex biotic processes were interpreted. Firstly, the use of many compound sentences in the TT makes it

difficult to achieve style equivalence. For instance, in the ST 27, there are seven compound sentences to interpret the features of '*Ampelopsis Glandulosa* var. *Kulingensis* (Kuling Porcelain Berry)'. The TT 27 was also mistakenly interpreted into seven compound sentences to make a long and complex sentence, because this is not in line with the simple, short and concise language style of English. In contrast, compound sentences in the ST 30 were transformed into many simple and short sentences in the TT 30 when the features of '*Caesalpinia bonduc* (Linn.) Roxb (Gray Nickernut)' were interpreted. Guided by this effective interpretation, compound long sentences in the ST 27 are also divided into simple and concise sentences in the TT. Therefore, to achieve style equivalence, the ST 27 should be optimised as 'Kuling Porcelain Berry is a vine with hairless branchlets, petioles and inflorescences. Leaves are alternate, simple or compound, with a length of 5–16 cm and a width of 4–16 cm. The flowers are hermaphrodite and born in cymes opposite the leaves, each flower has 4–5 free petals that extend and fall off individually. The calyx is inconspicuous. Stamens are short and identical in number with the petals. The ovary is inferior to the receptacle and has 2 locules, with soft styles. Fruits are 5–10 mm in diameter, circular, containing 1–4 seeds and usually are blue or red'. In this way, the TT completes the transformation of linguistic dimension and communicates effectively.

Secondly, the mistakes of word order and voice in the TT also lead to style inequivalence in interpreting flora. According to Jiang and Niu (2022), Chinese language has equally coordinated elements in the sentence (paratactic) while English subordinates parts of the sentence to other parts (hypotactic). This means English focuses on logical priority. In English language style, significant information is usually put first and then detailed information follows. In the ST 31, important information and accurate voice were identified by the interpreter. Therefore, '此柏为岱庙标志性景观之一' was put first to interpret at the beginning of the TT. Besides in this text, '所植' was interpreted into 'was planted' which was passive in English because '植' is an implicit passive in Chinese. Thus, the TT 31 is concise and complete which obeys linguistic and communicative dimensions of Eco-translatology to achieve style equivalence. This successful interpretation can guide the interpreter to revise the interpretation of text 28. In text 28, '距地表2.60米' cannot be interpreted at the beginning of the TT because it is detailed information. Besides, '被认为' is an explicit passive in this text. Therefore, it should be interpreted into passive rather than active. Therefore, restructuring the word order and using passive are successful ways to interpret text 28 to achieve style equivalence. The whole version of the TT 28 should be rendered into 'On a tree trunk there is a globular burl, and on a branch above, extending northward, is a moon-shaped scar. Together these suggest a Chinese mythical creature, a chimerical Qilin, looking at the moon. The effect is enhanced by the height of the burl, 2.6 m (8.5ft). This is why the tree is named the Cypress of a Qilin in Moonlight. For thousands of years, Qilin has always been seen as the symbol of auspiciousness, and its looking at the moon implies people's aspirations to live a better life. This is one of the eight strange-looking ancient cypresses in the vicinity of Daimiao Temple'. This version is successful in communication and is authentic to style interpretation.

Finally, misinterpretation of a long sentence in the biotic process also results in style inequivalence. For example, the last long sentence of the ST 29, the growing environment of '*Cycas revoluta Thunb* (Sago Palm)'. By contrast, during interpreting plant strangulation (text 32), a long sentence in the ST was interpreted into three short and simple sentences in the TT to obey Eco-translatology which makes the TT concise. The ST 29 should be improved into 'In the tropical and subtropical regions in southern China, specimens over 10 years old bloom and bear fruits almost every year. In contrast, specimens in and to the north of the Yangtze River Basin usually do not bloom all year round, or only bloom and bear fruits occasionally'. The long sentence was divided into two short and simple sentences.

The challenges of cultural differences can be illustrated in several examples of cultural inequivalence. Data 7 (text 33–34), local Chinese names of flora are not accurately and scientifically interpreted for geotourists probably because interpreters lack a full ecological cultural background, '稔子' (text 33) was interpreted into 'Renzi' via inaccurate strategy UCPREW. '红果草' (text 34) which was literally interpreted into 'red fruit grass', a misinterpretation. Text 35, '点不' was successfully interpreted into 'Java Apple', because '点不' was called '莲雾' by local Hainanese. In English, 'Java Apple' can correspond '莲雾' directly. Thus, '点不' was also 'Java Apple'. This interpretation points the way to improve the interpretations of text 33 and text 34. In terms of '稔子' (text 33), '桃金娘' (myrtle) was called '稔子' by local Cantonese. Thus, the interpretation of '稔子' is the same interpretation as '桃金娘', 'myrtle'. In terms of '红果草' (text 34) also called '艾堇' by Cantonese and Hainanese, it cannot be interpreted into 'red fruit grass', because geotourists may regard '红果草' as an edible grass. There is no English phrase to correspond to '红果草'('艾堇') directly so in this case, the Latin scientific name of '艾堇' *Sauropus bacciformis* can be a bridge to English interpretation. In Latin, '*Sauropus*' is the genus of '艾堇' which is a noun while '*bacciformis*' is the specific epithet of '艾堇' which is an adjective. Therefore, Latin language is a 'noun + adjective' structure. The Latin adjective '*bacciformis*' means 'Berry-shaped' in English. Because the genus of plants is named according to their features and types, to make it understandable, genus of plants can be replaced by types of plants such as trees, shrubs, bushes, herbs, climbers and creepers. According to the specific context of the interpretation of '艾堇' in text 34, it belongs to herbs. Therefore,

the Latin noun '*Sauropus*' can be replaced by 'herbs'. Compared with Latin, the structure of English is 'adjective + noun'. Thus, '红果草' ('艾堇') should be interpreted into 'Berry-shaped herb' to achieve cultural equivalence.

Similarly, to analyse poor and effective interpretations of fauna, the function formulas [word = "BE"] [word = ","] [word = "FA"] [word = ","] [word = "PT"] and [word = "BE"] [word = ","] [word = "FA"] [word = ","] [word = "ET"] was used to concordance the PGC. The results show that there are similar interpretation problems to flora interpretations. Selected examples for contrastive analysis from the PGC are in Data 8 to Data 10. At the semantic level (Data 8: text 36–38), firstly, ITSN fails to achieve semantic meaning when names of fauna were interpreted. For example, '赤鳞鱼 (螭霖鱼)' (text 36) in the PGC occurs 110 times, but it was inconsistently interpreted into four versions: 'Red Fish Scales', 'Chilin Fish', 'Red Scale Fish', and 'Red-scaled Fish'. However, '点斑原海豚' (text 39) in the PGC appears 77 times which was consistently interpreted into '*Stenella attenuate* (Pantropical Spotted Dolphin)'. This version achieves semantic equivalence. Text 36, '赤' is a Chinese colour term which means 'red'. '赤鳞鱼 (螭霖鱼)' is a unique fish only found in Mount. Taishan and it lives in large groups in the Colourful Stone Stream. Therefore, in English, text 36 should be rendered into 'Mount Taishan Red-scaled fish' to achieve semantic equivalence. Secondly, the underlined sentence was omitted describing the relationship between fish and fish culture in ST 37. Compared with a complete and detailed interpretation of the characteristics and living habits of spadefish (text 40), Text 37 will not convey complete meaning of the ST to geotourists. ST 37 should be optimised into 'Fish culture is an important part of traditional Chinese culture, which symbolises the creative spirit of the Chinese nation. It is not hard to see that fish culture has long played multiple roles in diverse areas throughout Chinese history and carries a hint of artistry'. Apart from ITSN and NT, the uses of inaccurate language and non-standard English expression also lead to misinterpretation. For example, '枕部' (text 38) was interpreted into 'headrest' but because this relates to chairs not birds, it should instead be 'crest". '白杂黑' was interpreted into 'white and black' but should be interpreted into 'black and white' rather than 'white and black' according to the order of English language habit. To achieve semantic equivalence, high formal and standard English expressions were used in text 41 to interpret the features and living habits of Kentish Plover such as 'migrate reasonable distances' and 'abundant water'.

At the style level (Data 9), misinterpretation causes style inequivalence when interpreting features of fauna. Short and simple is one of principles of geotourism interpretation. *Sousa chinensis* (Chinese White Dolphin) in text 46 is interpreted into three short and simple English sentences which achieves style equivalence. However, the characteristics of *Accipiter gentilis* (Goshawk)' in text 42, turns the three Chinese compound sentences into three compound sentences in the TT which results in misinterpretation. Text 42 should be revised into 'The Northern Goshawk is a species of medium-large raptor, which reaches about 60 cm (2 ft) in length with a 1.3 m (4.3 ft) wingspan. It has a dark head with a wide white stripe over the eye, a white nape and fine grey bars on the breast. Its back is dark brown and its rudderlike tail is mostly grey with four black bars. Its wings are wide and light grey with black streaking below. Females are obviously heavier than males.' In this successful version, long sentence was divided into simple and short sentences. Text 43 fails to interpret well, in this text, '黑尾塍鹬, 中型涉禽, 体长36-44厘米。嘴、脚、颈皆较长。' was rendered into two sentences 'The black-tailed godwit is a medium-sized wading bird. It has a body length of 36–44 cm.' Text 43 was better rendered into one sentence: 'The Black-tailed godwit is a medium-large wader at 36–44 cm (14–17 in), with long bill, neck and legs. By contrast, text 47 fits style equivalence based on rules of Eco-translatology. Two Chinese sentences '珊瑚是珊瑚虫分泌出的外壳。珊瑚虫是珊瑚虫纲珊瑚目动物。' were interpreted into one English sentence via combination: 'Corals are the shells secreted by coral polyps, which belong to the Gorgonacea invertebrates within the class Anthozoa.' This concise version can be understandable for geotourists. To avoid repeated use of pronouns 'it' or 'its' in the whole process of interpretation, a relative clause can be used as a bridge to translate two Chinese sentences into an English sentence with complete information for geotourists.

Moreover, the use of short sentences and accurate passive can achieve style equivalence when features of fauna were interpreted. In text 47, short sentences and passive were accurately used to interpret the formation and features of coral. Firstly, the last long sentence was divided into five English short sentences. Furthermore, implicit passives were identified. For example, '分泌' was interpreted into 'be secreted' and '固定' were interpreted into 'be fixed'. This also conforms to transformation of linguistic and communicative dimensions. By contrast, when interpreting features of pied harrier (text 44) and white butterfly oyster (text 45), there were misinterpretations. In text 44, long sentence '头部、颈部、背部和胸部均为黑色, 尾上的覆羽为白色, 尾羽为灰色, 翅膀上有白斑, 下胸部至尾下覆羽和腋羽为白色, 站立时外形很像喜鹊, 所以得名。' was also rendered into a long sentence in the TT 44. This does not accord with the simple and concise language style of the English language. In text 45, '其分泌的角蛋白和碳酸钙可包裹外来物质形成珍珠。' was interpreted into 'The keratin and calcium carbonate it secretes can wrap foreign substances to form pearls.' This interpreter ignored the implicit passive '形成'. Guided by the interpretation of text 47, to achieve style equivalence, the ST 44 should be improved into 'Its head, neck, shoulders and upper chest are black, while below — from the lower chest to

the axillaries and covert feathers under the tail — are white. The tail feathers are grey, and its wings have white patterns. In Chinese, it is called "magpie harrier" because it looks like a magpie when perching.' Long sentence in the ST was divided into three short and simple sentences. In the ST 45, '形成' should be rendered into passive 'be formed'. Thus, the whole ST 45 should be revised into 'A pearl is formed when an irritant works its way into the Pinctada maxima and the oyster defends itself by secreting a fluid, which mainly consists of keratin and calcium carbonate, to coat the irritant'.

Data 10 (text 48–49) demonstrates poor and effective interpretations of fauna names at the cultural level. The problems of this level are similar to interpretations of flora names in the cultural level. The interpreter lacks ecological background which results in failure to interpret Chinese local fauna names. For example, '水鱼' (text 48), also called '鳖' by local Cantonese, was literally rendered into 'water fishes' which is mistranslated. Text 49, '麻鹰' was rendered into 'black kite' rather than 'eagle' or 'hawk'. This is a successful interpretation which follows Eco-translatology, because '黑鸢' was called '麻鹰' by local Cantonese and Hainanese. '黑鸢' is 'black kite'. In English, 'Chinese Softshell Turtle' can directly correspond to '鳖'. Thus, guided by the three dimensions of Eco-translatology, '水鱼' was also interpreted as 'Chinese Softshell Turtle' to achieve cultural equivalence. Because the above two Chinese local flora names are located in the text of interpretative panels, English only can be used to interpret them to accord with concise and simple principles of geotourism interpretation.

Cultural Element According to the SSC Model

To obtain the results of the CE in the corpus, the function formulas [word = "CE"] [word = ","] [word = "PL"] [word = ","] [word = "PT"] and [word = "CE"] [word = ","] [word = "PL"] [word = ","] [word = "ET"] were used to search for relevant cultural failed and effective interpretations. The examples selected for contrastive analysis are in the Data 11 (text 50–58). In summary, Data 11 (text 50–54) shows inaccurate strategies such as NT, Mistranslated, ITSN and UCPREW can result in semantic (meaning) and/or cultural inequivalence. This can be on a lexical (word) and/or a syntactic (grammatical) level. A failure in meaning transference or semantic inequivalence, in this case, is closely related to cultural issues of difference. The translator's lack of SL cultural background thus leads to ineffective interpretation of local poetic, religious, historical and stone sculpture culture, which causes this cultural inequivalence.

Firstly, poetic and historical features of data were not completely interpreted causing semantic and cultural inequivalence. For example, a line from a poem '登泰山而小天下' (text 50) written by Mencius and historical culture '探花' (text 51) were completely omitted. Therefore, the true semantic and cultural significance cannot communicate the content of the ST to geotourists. The omitted content of the '登泰山而小天下' (text 50) and '探花' (text 51) should be supplemented in accordance with the three dimensions of Eco-translatology and principles of geotourism interpretation. Thus, '登泰山而小天下' (text 50) should be interpreted as 'Confucius ascended Mount Taishan and 'all beneath the Heaven appeared to him small'. '探花' (text 51), in ancient Chinese dynasties, refers to the third place in the imperial examination. Thus, this connotation cultural meaning, 'the third place in the imperial examination', should be supplemented in the TT. By contrast, Chinese historical figure, Confucius (text 55), was effectively interpreted, because the interpretation content is not only detailed and complete, but accurately conveys the semantic and cultural meaning of Mencius's poetry line '孔子登东山而小鲁, 登泰山而小天下。'.

Furthermore, even if translators can understand the basic meaning of the data, they might miss the cultural connotation of, for instance, Chinese religious beliefs, resulting in ITSN. '碧霞祠' (text 52) appears 69 times in the PGC, with a total of three versions of interpretation: 'The Shrine of the Blue Dawn', 'Azure Cloud Temple' and 'Bixia Temple'. This interpreter has not fully understood the original culture. However, an example similar to text 52, '青帝庙 (宫)' (text 56) appears 79 times in the PGC and was consistently interpreted into 'The Green Emperor Temple'. The connotation of this religious culture was identified by the interpreter. Firstly, '太昊伏羲 (Fuxi)' was enshrined in '青帝庙 (宫)' who is one of the five emperors in Chinese mythology. Therefore, it should be an emperor temple. Besides, in Chinese culture, '青帝' is the one who presides over the east, for 'green' corresponds to the east in the theory of the five elements. Therefore, '青帝庙 (宫)' should be interpreted into 'The Green Emperor Temple' to achieve three dimensional transformation of Eco-translatology and cultural equivalence. '碧霞祠' (text 52) can be optimised with reference to the interpretation of text 56. In terms of text 52, the words 'shrine' and 'temple' in English have different meanings because the terms have different purposes. A shrine can simply be a pile of rocks that are consecrated to someone or some god while temples accommodate priests/priestesses and/or people for worship of a deity or goddess. A shrine can also be a single constructed monument but a temple is essentially a building with inside space. Therefore, because the bronze statue of '碧霞元君' is housed and worshipped inside '碧霞祠' a space, it is a 'temple' rather than a 'shrine'. In regards to the accurate naming of shades of color in English, '碧', cyan, is perceived in English as azure. Based on this, '碧' should be rendered into 'azure' rather than 'blue'. As well, the word 'cloud' is more accurate than the word 'dawn' in interpreting '霞'. Moreover, 'azure dawn' may be unimaginable to English readers. Thus 'Azure Cloud Temple' is an accurate version to interpret '碧霞祠' which

achieves the semantic and cultural equivalence of the three dimensions of Eco-translatology. This also explains why '碧霞祠' cannot be interpreted into 'Bixia Temple'. Although '碧霞' can be regarded as Chinese cultural characters which can be interpreted as 'Bixia', Li et al. (2022) claim when Chinese cultural characters contain connotational meaning, it should be explicitly interpreted to geotourists.

Thirdly, in text 53, '东岳大帝', '碧霞元君' and '泰山石敢当' were misinterpretation, because they did not carry the meaning of the original culture. However, the interpretation of text 56 accurately conveys cultural connotation of Chinese folklore and beliefs to geotourists. In text 56, '武相石狗' and '文相石狗' were effectively translated as 'Valiant Stone Dog' and 'Peaceful Stone Dog'. The expression of '武相石狗' is ferocious, representing the warrior value of valour (here "valiant') while the literal 'smiling face of' '文相石狗' signifies 'peaceful'. Geotourists can visibly confirm the data in the dogs' expressions. These are all cultural examples achieving semantic and cultural equivalence. The misinterpretation of text 53 can be improved, guided by the effective interpretation of this text. In text 53, '东岳大帝' is a term used to mean the incarnation of Mount Taishan, the holy messenger of heaven and earth. Therefore, '东岳大帝' is a deity rather than a human emperor. Thus, it should be interpreted into 'Dongyue Dadi (the Great Deity of Mount Taishan)' instead of 'Emperor Dongyue'. Similarly, the term, '碧霞元君' is the Taoist name of the Goddess of Mount Taishan. Therefore, '碧霞元君' should be translated as 'goddess' rather than an 'emperor'. Based on the above analysis of '碧霞', '碧霞元君' should be rendered into 'Bixia Yuanjun (Goddess of the Azure Cloud)' to convey the meaning of its connotation. Although '泰山石敢当' can be translated as 'Mount Taishan Stone', again, the mountain is termed a deity, a protective guardian. Hence, '泰山石敢当' should be interpreted as 'Taishan Shigandang (meaning 'stone tablets that can drive away misfortune and evil spirits')'.

A final example can be taken from Chinese geographical and calligraphic culture. For example, text 54, '《水经注》' is mistakenly interpreted into 'Shuijingzhu', because the UCPREW strategy cannot accurately express the semantics or convey the connotation of Chinese geographical culture to geotourists. A small interesting comparison to the above example is in text 58, where addition was used as a strategy to interpret '篆书' into 'Zhuanshu (an ancient Chinese calligraphy style)'. Through addition, geotourists are familiar with Chinese calligraphy in general from ancient China. Similarly, to achieve semantic and cultural equivalence, addition can also be used to interpret text 54. '《水经注》' refers to an ancient treatise on the concept of the country's waterways and canals, compiled during the Northern Wei Dynasty by Li Daoyuan (386–534 AD). Therefore, text 54 should be interpreted as '*Shuijingzhu* (*Commentary on the Water Classic*)'.

SSC Model Formation

Through the corpus-based contrastive analysis of the PGC, the detailed SSC model was shaped. Eight different criteria were embedded in the three parameters of sematic, style and cultural equivalence. Firstly, for semantic equivalence, linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of geo-information should be followed. In terms of linguistics accuracy, the major goal of geotourism translation and interpretation is communicable information. Therefore, language should be used which can empower geotourists to imagine, visualise and understand. In terms of scientific accuracy of terminology, the TT should transmit the science meaningfully. In terms of reader acceptability of terminology, both Latin and English can be used to interpret and translate biological terms such as flora names and fauna names. Geo-information should be interpreted and translated completely and in detail to geotourists and this geo-information cannot be omitted. The detail and completeness of the translation and interpretation not only increase the readability and lucidity of geotourism text, but realise the purpose of geotourism.

Secondly, when ABC elements were interpreted, logical syntax, concise syntax and appropriate voice syntax can help interpreters to achieve style. At the logical syntax level, translators and interpreters should identify and understand the logical relationship of the sentences. In the hypotactic language of English, important geo-information should be put first and then detail following. At the concise syntax level, long and complex sentences should be shifted into short and simple sentences for geotourists. Meanwhile, complex and redundant information in the ST should be simplified. In the appropriate voice syntax level, passive and active voice should be used appropriately during interpreting and translating complicated GPs and biotic information for geotourists. When complicated GPs are interpreted and translated, passive voice is recommended, because many implicit and explicit passives are embedded in the ST. In contrast, active voice is usually used to interpret and translate complicated biotical information, because most biotical information is related to flora and fauna features and life habit. This means simple possessive and describer verbs such as '具有/有 (have)' and '是 (is/are)' are in the ST. These verbs are simple, and just connect descriptive terms. However, when interpreting and translating biotical information, passive voice is also used occasionally such as implicit passive '覆盖 (cover)' and '形成 (form)' as well as explicit passive marker '被' in the ST.

Finally, when the interpreters carry out cultural transmission, the rule of accurate cultural connotation should be followed to achieve cultural equivalence. There is much

geological, ecological and local Chinese culture embedded in geotourism discourse. When this culture is interpreted and translated, the connotation rather than literal meaning for geotourists should be conveyed via effective strategies. The SSC evaluation model based on Eco-translatology combined with principles of geotourism interpretation is illustrated in Fig. 5.

Conclusions

Through corpus-based contrastive analysis of the PGC, guided by Eco-translatology combined with principles of geotourism interpretation, the SSC model was shaped to evaluate and improve the quality of C-E geotourism translation. As can be seen from Fig. 5, in the SSC model, there are eight criteria for assessing the quality of C-E geotourism interpretation embedded in three parameters (semantic equivalence, style equivalence and cultural equivalence). This means in summary, that with the SSC model to achieve semantic equivalence, interpreters and translators should obey four rules which are: linguistic accuracy, scientific accuracy of terminology, acceptability of terminology, and completeness of geo-information. To realise style equivalence, three criteria: logical syntax, concise syntax, and appropriate voice should be followed. To achieve culture equivalence, the connotation of culture should be conveyed. Based on this model, the specific process of evaluating C-E geotourism translation and interpretation quality in Chinese UGGps was summarised in Fig. 6.

The implication of findings in this research is, geotourism interpretation can now have its own customised evaluation model and evaluation process. The process and model can be used to assess and improve the quality of C-E geotourism interpretation and translation in Chinese UGGps. Meanwhile, this model can also serve as a theoretical basis for labelling geotourism corpus in future corpus-based geotourism interpretation and translation studies. Apart from the linguistics level, the results may also be applied for geotourism purposes. Firstly, the optimisation of interpretation quality of China UGGps is conducive to the growth of the geotourism market. Effective geotourism interpretations can attract more geotourists to Chinese UGGps which contributes to boosting the development of the economy and therefore, also the livelihood of local communities. Secondly, optimised geotourism interpretations are helpful to geotourists concerning geotourism education in the Nature Resource Science Popularisation Centres and International Field Study Centres

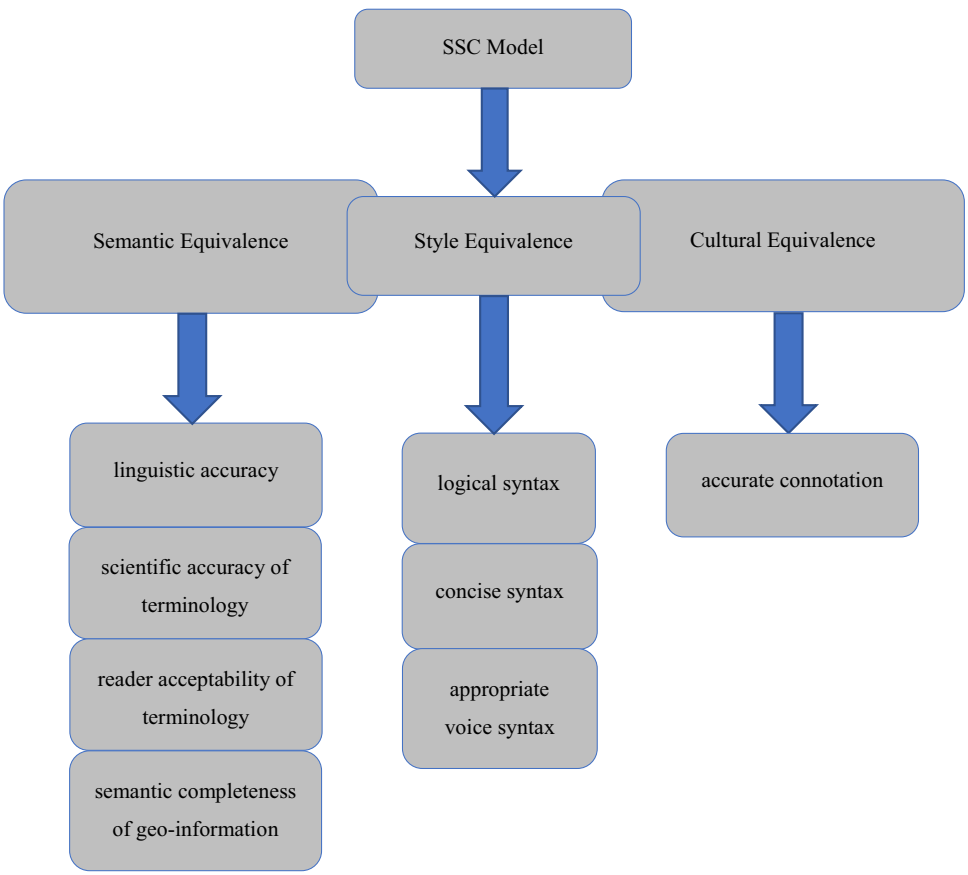

Fig. 5 SSC model of benchmarking for C-E geotourism interpretation showing eight criteria

of geoparks. Effective interpretations empower the goal of geotourism, that is, that geotourists imagine, visualise, better understand and appreciate our Earth. This will achieve a broader and shared mission of conservation, more specifically geoconservation.

A limitation of this research may lie in the size of the data set which consists of 80,000 Chinese and English parallel corpora from two Chinese UGGps. This means that in the process of analysing and exploring the SSC model, individual cases of effective or poor translation and interpretation of ABC may be missed. This may affect the effectiveness of the SSC model. To minimise the impact of this limitation on empirical research, two representative geoparks, Taishan UGGp and Leiqiong UGGp, were selected, because they contain rich ABC elements and have improved through different stages of ongoing development of their interpretation system.

Because this is the first geotourism translation quality evaluation model obtained through empirical research, ineffective translations were optimised into effective translations through this model (Fig. 6) but they are still not tested by geotourists, nor is there any feedback from them. Therefore, in future empirical research, this model needs to be verified with more data from other Chinese UGGps so that it can become more effective.

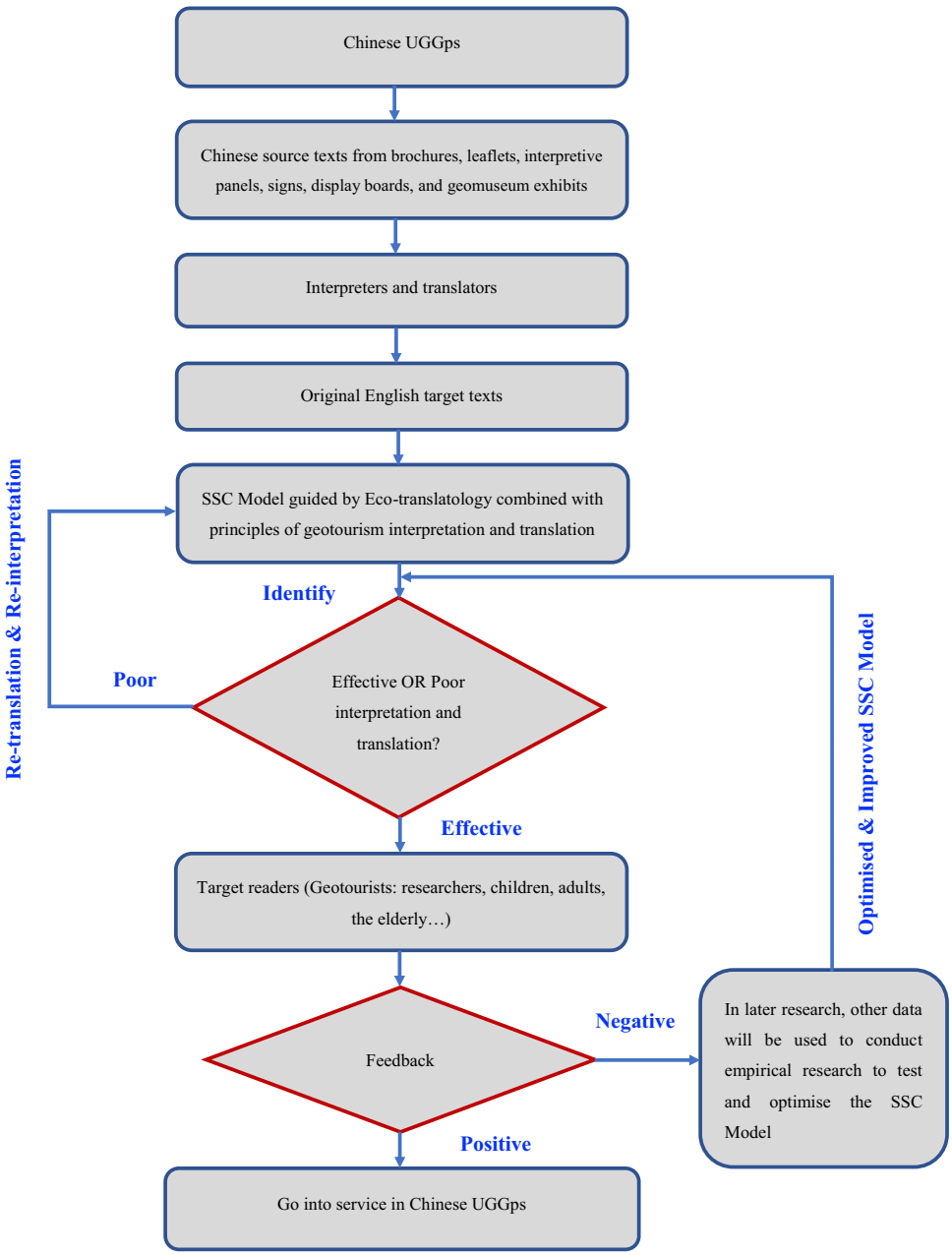

Fig. 6 Diagram of assessing C-E geotourism interpretation quality in Chinese UGGps

Appendix

Table 1 An exhaustive glossary of linguistic terms

No	Linguistic terminology	Comments
1	<s>	In the PGC, this symbol indicates the beginning of a complete sentence
2	</s>	In the PGC, this symbol indicates the end of a complete sentence
3	Addition	Addition is an interpretation strategy of inserting new words, short or long sentences to interpret the connotation meaning to geotourists
4	Chinese Pinyin	Chinese Phonetic Alphabet
5	Corpus-based contrastive analysis	In this paper, it means analysis of effective and ineffective geotourism interpretation data by contrast in the PGC. Through quantitively and qualitative analysis, effective interpretations provide optimisation direction for poor interpretations
6	Corpus linguistics	Corpus linguistics, also called corpora, is an approach that employs enormous electronically accessible collections of spoken and written texts to conduct empirical studies (both quantitative and qualitative) of language use
7	Cultural bound terms	Cultural-bound terms, or cultural-specific items, are those that have no analogues or distinct placements in the target reader's cultural system, resulting in difficulty in translating their functions and meanings from the source text to the target text
8	Cultural equivalence	For the purpose of interpretation or translation, cultural equivalence is a broad term encompassing the appropriate words to carry the whole meaning of historical, literary, artistic or social references of a particular culture
9	Eye-tracking studies	Eye-tracking is a popular technique which is used to examine cognitive effort involved in written translation, audiovisual translation and conference interpreting
10	Explicit passive structure	In Chinese,'被' is the marker of explicit passive structure which is similar to the structure of 'be + done' in English
11	Extralinguistic cultural references (ECR)	ECRs frequently represent the distinctive characteristics of a culture. The inhabitants of another culture are generally unfamiliar with such cultural terminology, and their language does not have an equivalent term/s
12	Implicit passive structure	In Chinese, although the structure of '被' does not appear, this structure implies passive, such as '分布 (be distributed)' and '覆盖 (be covered)'
13	Interpretation/translation strategy	A technique for interpreting or translating a linguistic unit into another language
14	Interlingual subtitling	Interlingual subtitling is the process of translating the original language (OL) into the target language (TL) by retaining the OL, and embedding the TL synchronously at the bottom of the screen or picture
15	Intralingual subtitling	Intralingual subtitling, also called vertical subtitling translation, converts discourse into untranslated text. Thus, intralingual subtitling is subtitling within the same language
16	Local Chinese flora/fauna name	The specific name given to flora and fauna by local people. Thus, these names may contain much ecological cultural knowledge such as local dialect
17	Manually aligned	A research technique in which, because the machine is not trained to always match the source and target texts properly, some manual adjustment is necessary to straighten up the corresponding sequences
18	Parallel geotourism corpus (PGC)	PGC is one-to-one correspondence between Chinese and English geotourism text, formed in Sketch Engine software through automatic alignment, tagging, and manual alignment
19	Semantic equivalence	Language terms, not necessarily having the same form of grammar, but equivalent in meaning
20	Sketch Engine	A software tool for quantitative and qualitative analysis of the PGC
21	Skopos Theory	Skopos Theory is a translation theory which was developed in Germany in the late 1970s. Skopos rule, coherence rule and fidelity rule are three application rules of Skopos Theory
22	Specific Chinese cultural words	These are words that reflect unique Chinese culture, connotations and style
23	Style equivalence	The interpretation that matches the source language style while being suitable for target readers
24	Subtitle strategy	Translation technique for effective subtitle translation
25	Tagging (annotation)	Application of special symbols to annotate effective and ineffective data in research for control purposes. It aids in corpus retrieval. (Thus, a corpus can easily be used to store additional linguistic data.)
26	Tmxmall	A software bilingual corpus alignment tool which includes both manual and automatic machine alignment

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Author contribution Qiang Jason Li, as Author 1 and corresponding author, he first proposed this research topic. Based on this research topic, he mainly conducted fieldwork to collect data, process data and construct the bilingual parallel corpus. Finally, Jason wrote the entire paper. Fangzhou Noah Zhu, as Author 2, gave Jason some advice on the research question and paper structure. As a geotourism and interpretation expert, Dr Young Ng, as Author 3, offered Jason background information and helpful suggestions. He also read the whole paper and gave Jason some useful comments on geotourism and translation before this paper was submitted.

Declarations

Conflict of interest The authors declare no competing interests.

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