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A Study of E-C Translation of Scientific and Technical Texts From the Perspective of Functional Equivalence Theory

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Scientific and technical English plays a crucial role in international communication, and the study of its translation holds significant importance for English translators. Based on Nida's Functional Equivalence Theory, this study focuses on the translation of scientific and technical English texts, exploring their characteristics in terms of vocabulary, syntax, discourse, and style. It also examines the practical application of Functional Equivalence Theory in the translation process. Through case analysis, the study finds that the translation of scientific and technical texts primarily employs methods, such as literal translation, amplification, division, and conversion, while free translation is used less frequently. Under the guidance of Functional Equivalence Theory, translators can effectively improve translation quality by appropriately applying these strategies. Therefore, this theory not only provides theoretical guidance for enhancing the quality of scientific and technical English translation, but also contributes to the professional development of translators.

Keywords: technical English, Functional Equivalence Theory, translation strategy

Introduction

Research Background and Significance

To maintain the objectivity and accuracy of scientific and technical English translation, translators often adopt source-oriented strategies. However, the influx of foreign scientific texts through international exchanges has led to varying translation quality. According to Nida and Taber (1974), the reader's response is a crucial standard for assessing translation quality. His theory of functional equivalence provides important guidance for scientific and technical translation by balancing fidelity and readability. Although functional equivalence has its limitations, it is particularly applicable to the translation of scientific and technical texts due to its emphasis on conveying meaning effectively to the target audience.

Research Contents and Question

This paper examines the application of Nida's Functional Equivalence Theory in the translation of scientific and technical English texts, based on the current situation of scientific and technological translation in China. Adopting a case study approach, the research selects 15 texts from *Translation of Scientific and Technical English* (Xie, 2015) as its corpus. The study explores how functional equivalence is applied across four linguistic levels: lexical, syntactic, textual, and stylistic.

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Literature Review

Previous Studies on Scientific and Technical English Texts

With the rapid advancement of science and technology, scientific and technical English has been increasingly applied across various disciplines. Correspondingly, the translation of scientific and technical English has attracted growing scholarly attention both domestically and internationally. Existing studies mainly focus on linguistic features, translation strategies, and the application of translation technologies, reflecting a multidimensional approach to this field of research. In terms of linguistic characteristics, Borucinsky and Kegalj (2019) analyzed complex noun structures in scientific English, pointing out that the positioning of modifiers contributes to semantic clarity. From a historical linguistic perspective, Degaetano-Ortlieb and Teich (2022) examined the development of scientific English from the mid-17th to the late 19th century by building computable language models. In translation practice, researchers have explored ways to enhance both accuracy and readability. Xin (2022) emphasized the importance of flexibility in translating aviation technical English textbooks to improve readability. Dong (2022) proposed a systematic set of translation principles and methodologies aimed at improving the effectiveness of technical English translation. Additionally, some studies have focused on domain-specific translation and language comprehension. Kanani (2018) explored the translation process in operational training materials for small vessels, highlighting the challenges of technical terminology. Cutolo, Battista, and Testa (2021) conducted a study on Italian undergraduate and graduate physiotherapy students' perceptions of scientific English, suggesting that more targeted pedagogical strategies are needed to address knowledge gaps.

In China, the translation of scientific and technical English has also received increasing scholarly attention. Domestic researchers have explored this field from various theoretical perspectives, focusing on translation strategies, discourse coherence, and the handling of complex sentence structures. Several scholars have addressed translation strategies and discourse coherence. Li and Liu (2008) examined lexical articulation and translation strategies, arguing that lexical articulation serves as a key mechanism for maintaining coherence in scientific discourse. Other scholars have explored theoretical approaches to technical English translation. Yu (2012) focused on the translation of long and complex sentences, a common feature of scientific writing. From the perspective of functional equivalence, Huang and Liu (2013) analyzed the translation of long sentences in technical English, concluding that Functional Equivalence Theory can significantly enhance translation quality by improving the clarity and accuracy of complex syntactic structures.

Studies on the Application of Functional Equivalence Theory

The application of Functional Equivalence Theory has garnered considerable attention since its introduction in the 1980s, particularly in fields, such as legal translation, film subtitling, and the translation of scientific and technical texts. Scholars, both internationally and domestically, have extensively examined the theory's potential to enhance the quality and efficiency of translations.

Internationally, Nida (1969) pioneered the conceptualization of translation as a scientific discipline, emphasizing the pivotal role of linguistic theory in shaping translation practices. Expanding on Nida's framework, Shiflett (2012) explored the application of Functional Equivalence Theory in legal translation, arguing that legal translators must employ a variety of strategies to achieve equivalence, especially when translating complex legal terminology. More recently, Sun and Wan (2022) applied Functional Equivalence Theory to Chinese newspaper

translations, demonstrating its practical effectiveness in ensuring that translated texts fulfill the same communicative function as the original, thereby enhancing translation quality.

In China, the application of Functional Equivalence Theory has been actively investigated across various translation domains. Shao (2009) analyzed the theory's application to film subtitling, concluding that functional equivalence provides a more effective framework for ensuring clarity and brevity in subtitles. Jia (2015) examined the application of Functional Equivalence Theory to the translation of scientific and technical English vocabulary, demonstrating that the theory offers valuable guidance for achieving precision and consistency in the translation of specialized terminology. Zhao (2017) applied the theory to the translation of scientific and technical English texts, arguing that Functional Equivalence Theory contributes to both improved translation quality and increased translation efficiency. Additionally, Zhai and Hu (2017) applied the theory to the translation of international political news, highlighting the practical benefits of using functional equivalence to enhance the accuracy and communicative impact of translated political texts.

The Concept of Functional Equivalence Theory

Nida puts forward the theory of functional equivalence, which means that translation does not pursue a rigid correspondence of words, but a functional equivalence of two different languages. Nida believes that translation is the reproduction of information in the source language in the most appropriate, natural, and reciprocal language, so he points out that there are two kinds of equivalence in translation: formal equivalence and dynamic equivalence (Nida & Taber, 1974). Formal equivalence and dynamic equivalence are two basic orientations of translation equivalence theory proposed by Nida, which breaks the traditional word-by-word translation method and creates a new standard for judging the quality of translated texts. Nida innovates formal equivalence into functional equivalence in the 1980s, and functional equivalence includes four principles: lexical equivalence, syntactic equivalence, textual equivalence, and stylistic equivalence.

Application of Functional Equivalence Theory in the Translation of Scientific and Technical English Texts

In scientific and technical translation, the primary goal is the accurate transmission of information. According to Nida's Functional Equivalence Theory, effective translation seeks the closest natural equivalent to the source language. In order to achieve functional equivalence, at the lexical level, affixation and conversion can be used. At the syntactic level, the passive voice can be changed to the active voice, and the division can be used. At the textual level, literal translation and amplification can be used. At the stylistic level, omission and linear translation can be used (see Table 1).

Table 1

Corresponding Corpus of the Four Principles of Functional Equivalence

Type	Lexical equivalence	Syntactic equivalence	Textual equivalence	Stylistic equivalence
Number	72	61	22	12

Affixation. In scientific and technical fields, common English words often carry specialized meanings. The affixation method, which forms new terms through prefixes and suffixes, plays a key role due to the strong word-formation capacity of English affixes.

For example, the prefix "anti-" (反) is added to the root word to form antimatter (反物质) and antiparticle (反粒子). The translation of "anti" into "反" ensures the form equivalence, and the translation of the root word

into the corresponding Chinese ensures the content equivalence, which is conducive to the readers' correct understanding of the information conveyed by scientific and technical terms in scientific and technical texts.

Conversion. Due to cognitive and structural differences between Chinese and English, mechanical word-for-word translation is inappropriate. As a result, word class conversion is frequently employed to align with target language conventions and ensure fluency.

For example:

SL1: A reduction in condensation is achieved by the use of steam jackets.

TL1: 使用蒸汽夹套可减少冷凝作用。

This sentence can also be translated as: "通过使用蒸汽夹套可以达到冷凝作用的减少". However, such a translation is not in accordance with the grammar of Chinese, and it is not suitable because it is awkward to read and easily misunderstood. Guided by the theory of functional equivalence, the noun "reduction" in the example sentence and the noun phrase "the use of..." in the example sentence are translated into verbs, which is conducive to the readers' correct understanding and the realization of lexical equivalence.

Translation of passive voice into active voice. A key syntactic feature of technical English is the frequent use of the passive voice, whereas passive constructions are less common in Chinese.

For example:

SL2: The experiment will be finished in a week.

TL2: 这项实验将在一周内完成。

SL3: The antenna is automatically stabilized in pitch and roll as the airplane changes attitude.

TL3: 当飞机改变飞行姿态时，天线会随着飞机的俯仰运动自动平衡。

The three English sentences above use passive voice to enhance clarity. In scientific and technical writing, the focus is on the results of research. Passive sentences center the process and result, meeting this need. Based on the grammatical differences between Chinese and English and the principle of functional equivalence, the author converts the passive sentences into active ones, ensuring translation fluency while clearly conveying the scientific content, thereby achieving syntactic equivalence.

Division. In scientific and technical English, long and complex sentences with scattered components often conflict with the Chinese preference for short and concise sentences. Following the principle of syntactic equivalence and a proper analysis of sentence structure, certain English sentence components can be translated into separate and shorter Chinese sentences.

For example:

SL4: An infra-red system could be useable in both anti-air and anti-ship engagements, but its inherent disadvantages related to some dependence on optical visibility and to sensibility to interference from natural or manmade sources make it less attractive in the surface than in the air role.

TL4: 红外系统既可用于对空作战，也可用于对舰作战，但是它有两个固有的缺点：一是对光学能见度有一定的依赖性。二是受天然或人工干扰源的干扰。因此该系统的对空作用较之对舰作用更为诱人。

In line with the principle of functional equivalence, the sentence is translated using the split-translation method, aligning with Chinese syntactic features and structure. This approach first identifies the two inherent disadvantages of the infrared system in air combat and then elaborates on them, ensuring syntactic equivalence and maintaining natural flow while preserving the original meaning.

Literal translation. Literal translation refers to maintaining the language form of the source text as much as possible when translating, including phrasing, sentence structure, rhetorical devices, etc., while also requiring smooth language expression.

For example:

SL5: Food quickly spoils and decomposes if it is not stored correctly. Heat and moisture encourage the multiplication of microorganisms, and sunlight can destroy the vitamins in such foods as milk. Therefore, most foods should be stored in a cool, dark, dry place which is also clean and well ventilated.

TL5: 食物如果保存不当很快会腐烂。温度和潮气都会助长微生物的繁殖，阳光会破坏牛奶一类食品的维生素成分。所以，大多数食物应该保存在既凉爽、黑暗和干燥，又干净、通风良好的地方。

This example consists of several simple sentences, which are typical of technical English. The translation is mainly based on a literal translation strategy with sequencing adjustments. Guided by the theory of functional equivalence, the literal translation method is used to translate the information about improperly preserved food without any modifications, reproducing all the information in the original text about food rotting if it is not preserved properly and achieving equivalence between the original text and the translated text on the textual level.

Amplification. According to the different ways of thinking, language habits, and expressions between English and Chinese, some words or phrases are added appropriately in the translation of scientific and technical English texts in order to more accurately express the following information conveyed by the original text.

For example:

SL6: Ultraviolet rays are waves similar to light which are just beyond the violet end of the visible light spectrum. Ultraviolet rays are sometimes called invisible light or black light because we cannot see them with the human eye.

TL6: 紫外线是一种与光相类似的波，他们超越可见光谱的紫色终端，因为我们肉眼不能看到紫外线，所以他们有时被称作我看不见的光或黑色。

In the process of translation, you can add some inner meanings in the original text. In this example, the translation is guided by the theory of functional equivalence and adds the logical relationship “because” to grasp the logical thought of the original text, thus forming a translation with equivalence.

Linear interpretation. If the sentence structure in English aligns with that of Chinese or if the translation does not conflict with Chinese linguistic habits and thought patterns, a direct translation following the original text’s structure is acceptable. Therefore, the translator should follow the theory of functional equivalence and adopt a linear translation approach, presenting the information from the source text objectively to achieve equivalence in style.

For example:

SL7: For these forms of pollution as for all the others, the destructive chain of cause and effect goes back to a prime cause too many cars, too many factories, too many detergents, too many pesticides, more and more trails left by supersonic jet.

TL7: 这些形式的污染像所有其他形式的污染一样，其破坏性的因果关系链可归根于一个主要的原因：太多的汽车，太多的工厂，太多的洗涤剂，太多的杀虫剂，越来越多的喷气式飞机留下的尾气。

The sequence and logical relationship of a series of events in this long English sentence is basically similar to the Chinese expression. Under the guidance of the theory of functional equivalence, the linear translation

method is used to translate directly according to the order of the original text, objectively reproducing the information expressed in the original text: All the contamination has only one main cause.

Omission. Because of the uniqueness of technical English, the translation needs to preserve the style of the source text and achieve equivalence between the source and the target text on a stylistic level. Therefore, in the translation, some words in the original text can be omitted from the translation.

For example:

SL8: First, a long glass tube is taken. The tube is closed at the top and is then completely filled with water. Next it is placed vertically in a large barrel half-full of water.

TL8: 首先取一根长玻璃管，将顶端封闭并盛满水，然后竖直地放在一只水半满的大桶中。

The "tube" in the second sentence can be omitted, and the first two sentences can be directly translated into one sentence to realize the concise style characteristic of scientific and technical English texts and achieve the stylistic level of equivalence.

Conclusion

This research explores translation strategies for scientific and technical English from the perspective of functional equivalence theory. At the lexical level, techniques, such as word class conversion and affixation can help achieve accurate terminology translation. At the syntactic level, passive constructions may be transformed into active ones, and long sentences can be divided to enhance clarity and equivalence. At the textual level, methods like literal translation and amplification are employed to reflect contextual meaning. At the stylistic level, maintaining consistency with the source text is essential, and strategies, such as linear interpretation and omission can be applied where appropriate.

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