

# Peculiarities of teaching translation of scientific and technical papers to engineering students

*Dmitry L. Matukihn*<sup>1,\*</sup>, *Nikolay A. Kachalov*<sup>1</sup>, and *Roman M. Fedorenko*<sup>1</sup>

<sup>1</sup>National Research Tomsk Polytechnic University, 634050 Tomsk, Russia

**Abstract.** The article deals with the issues and methods of teaching translation and interpretation of scientific and technical papers to engineering students from a linguistic point of view. The authors describe the concept and special features of technical translation as a professional activity compared to different kinds of translation. The paper analyzes stylistic, lexical and phraseological, and grammatical peculiarities of scientific and technical papers. Moreover, the authors suggest the main techniques of translating scientific and technical papers such as direct and indirect translation methods.

## 1 Introduction

Recently, a large number of state-of-art machinery, equipment and technology have been imported in the Russian Federation. The rate of exchange of scientific and technical information with other countries is increasing rapidly. As a result of these intrinsic reasons, the ability to translate a foreign language text and interpret speech is one of the major goals of teaching foreign language to engineering students. However, the translation is the most reliable means of verification of understanding a foreign language, its semantic and stylistic features. Special attention shall be drawn to teaching translation under the circumstances of limited contact hours in the engineering universities, as the translation is one of the most important elements of performance monitoring at different stages of mastering a foreign language. In the course of training a future expert it is required to provide the development of overall necessary professional and personal qualities, the leading of which is cognitive independence. Linguists note that the importance of the ability to organize independent activities is most clearly defined in the process of spoken and written foreign language communication that requires constant analysis of linguistic facts. Translation skills of technical documentation, manuals for industrial and household equipment are necessary for senior students of engineering specialties, doing practical training in various enterprises and institutions [1, 2].

Translation is an exact reproduction of the original source by means of another language while preserving the unity of content and style. It is believed that technical translation is less challenging than fiction translation, because the technical translator needn't look for equivalents of various metaphors and other stylistic means, which are inherent in fiction and journalistic style. Technical translation difficulty lies elsewhere. The basis of technical

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\* Corresponding author: [mdlbuddy@mail.ru](mailto:mdlbuddy@mail.ru)

translation is formal and logical style, which is characterized by precision, unemotionality and impersonality of information transfer. Technical translation shall be as close to the original source.

A slight deviation from the meaning may have unintended consequences (for example, inaccurate translation of technical equipment manuals can lead to an accident on the site). Therefore, in contrast to the fiction translation, technical translation does not allow any inaccuracies or deviation from the original source. In technical translation, each word and definition is translated precisely, eliminating ambiguity of understanding. Technical translation is saturated with various highly-specialized terms. Grammar of technical translations is characterized by the use of specific and firmly established grammar rules, e.g., *indefinite-personal and impersonal constructions, passive voice, and non-finite forms of the verb* [3]. Logical highlights are presented by means of inversion. Whatever the complexity of the information in a document to be translated is: description of technological processes, calculations of any parameters, principles of operation of equipment and its operating procedures, etc., the translator is required to understand the meaning of the text, and then skillfully and accurately convey it to the target language. Thus, technical translation is a special kind of translation, the quality of which depends primarily on the personality of a translator.

If one needs to quickly get acquainted with the simple technical documentation, it is sufficient to use computer-based translators. To provide in-depth study of scientific literature, translation must be performed by a professional who commands the foreign language and obtains technical knowledge in a particular area, e.g., electrical power engineering, heat power engineering, etc. The goal of training technical translation skills is to teach very accurately and clearly to convey in another language any technical information. No interpretation, no ambiguity, no distortion of the meaning is permitted. This paper dwells on the issues and methods of teaching professional translation of scientific and technical papers to engineering students from a linguistic point of view.

## **2 Peculiarities of translation of scientific and technical papers**

The peculiarity of technical translation of scientific documentation is an excessive amount of specialized terms, service and introductory words, frequent use of abbreviations, lexical neologisms, and realias. A significant role in the scientific and technical papers is played by prepositions and complex conjunctions (e.g., *in order that, provided that, as though, etc.*) which create logical connections between the individual elements of sentences. In addition, the scientific and technical papers frequently use adverbs, which are integral parts of the development of logical thinking. Under the realias of scientific and technical papers we understand the titles, the brands of equipment and materials.

Specialized terms are to be translated using special dictionaries and glossaries. The realias, as a rule, are not translated but transliterated or given in the text in their original writing (e.g., the Russian *GOST, Act, sputnik, etc.*). Optimal translation solution for the phraseology is a search for identical phraseological items in the target language. In the absence of direct correspondence, the original idiom can be translated by searching for similar phraseology items, having a similar meaning with the original one, but built on a different verbal and image basis. It should be remembered that idioms, often having similar meaning but different form in various languages, are uniquely emotionally and associatively colored, and not always interchangeable. Geographical names and well-known proper names are given in Russian transcription.

The translation process always takes place strictly within the logical thinking, i.e., those who are capable of thinking logically are likely to make the proper translation. Experts in logic say that to understand an unfamiliar term, we need to analyze the context. In the

course of this analysis, we set different semantic connections and relationships between the unknown term and other words, the meaning of which is well known. Such cases are very common in the translation from the foreign language into the native language [4].

*Stylistic peculiarities* of the translation of scientific and technical papers are language clarity, lack of expressive, emotional and imaginative patterns. The texts of technical manuals and specifications often contain sentences without a predicate or a subject, as well as sentences, consisting of recitations only. The accuracy of the scientific and technical translation is determined by how well the translator commands the source language and the subject of discussion. The clarity of the text can be defined as its semantic unambiguity. In [5] the authors identified three main categories of stylistic defects that deny the uniqueness of the text:

- sentence amorphousness;
- logical stress shift in the sentence;
- “parasitic” relationships between words.

The authors suggest that semantic unambiguity of the text can be achieved by overcoming such defects of style as the excessive use of possessive case, the repetition of the same single-root words in a sentence, agglomeration of long words, pseudo-scientific patterns, bureaucratic style, etc. It is necessary to avoid literal translation which always leads to the distortion of an original meaning, or violation of the rules of the Russian language. The literal translation is based either on formal resemblance of the English word with the Russian one, or the use of the main or most common meaning of the English word without considering the context as a whole, e.g.,

*plant – a herb not a station,*

*machinist – an engine driver not an operator,*

*package – wrapping not software, etc.*

Knowledge of the typical translation errors and their causes contribute to their prevention. Translation errors are divided into two main types: speech, and functional and informative. Speech errors, in turn, are subdivided into system-speech and normative speech errors. They feature a violation of the norms of language and speech standards (usage). Functional and informative errors are functionally unreasonable deviation from the original text, adversely affecting the transfer of its meaning. In terms of its negative impact on the quality of the original source translated, they are divided into the “distortions” and “inaccuracies”. The distortions are errors in the translation, misleading the translation recipient about the content of a source text. Inaccuracy features lesser degree of equivalence violations, and less misleading impact, e.g.,

*provide a means – give a chance not ensure a measure,*

*to process – for the procedure not to produce,*

*silicon – graphite not carbonium, etc.*

*Grammatical peculiarities* of the translation of scientific and technical papers are characterized by frequent use of participial and verbal adverb phrases, simple, expended and complex sentences, passive voice, infinitive, participial and gerund phrases.

The great danger for the translator lies in the fact that both English and Russian feature a lot of similar grammatical forms and syntactic structures, the functions and meanings of which do not match in the languages. Similar names of such forms and constructions, borrowed both in Russian and in English from Latin, should not be misleading. English infinitive and participle functionally and meaningfully differ from the corresponding Russian forms. In the course of translation, it is required to use grammatical transformations. Functional correspondence is achieved by a complete change of structures, word order and by replacing parts of speech and sentence, adding and omitting words. The ability to adequately translate foreign text is one of the goals of training, even though it is not aimed at training a highly-qualified translator. The essence of adequate translation is

not the transfer of letters but the spirit of the text. Each language has its own unique means, characteristics and properties, so to faithfully convey an image or phrase, sometimes a translator shall completely change them [6].

### **3 Translation methods of scientific and technical papers**

The translation process features a number of special methods aimed at creating adequate translation. Experts distinguish two translation methods: direct and indirect translation. Indeed, the message in the original language may properly be translated in the target language, since it is based on the parallel categories, either the parallel concepts. Although, sometimes due to structural or metalinguistic distinctions, some stylistic effects can't be transferred to the target language, without changing in varying degrees, the order of the elements or even lexical items [7, 8, 9]. It is clear that in the second case, it is necessary to resort to more sophisticated methods – indirect methods of translation. Borrowing, calquing and literal translation are methods of direct translation. Transposition, modulation, equivalence and adaptation – indirect translation.

#### *Direct translation methods*

*Borrowing* is the simplest method of translation. Borrowed approximately from 50 languages, lexical items account for almost 75% of the vocabulary of the English language and include layers of vocabulary borrowed from various historical periods and under the influence of different conditions of existence and development. Many borrowings under the influence of the system, into which they have entered, undergo significant phonetic, grammatical, and even semantic changes, adapting to the phonetic, grammatical and semantic laws of the system. The process of assimilation can be so deep that the foreign origin of such words is not obvious for native English speakers and is exposed only with the help of etymological analysis. This is most true for the Scandinavian and Latin borrowings, e.g., engineer, figure, get, skill, etc. It should be noted that the borrowings are often introduced to language through translation, among them are semantic borrowings, or "false friends", which should be avoided. For example:

*fixed – repaired not mounted,  
current – electricity not present/existing,  
realize – work out not understand,  
accurate – tidy not precise,  
conductor – a cable not a fare taker,  
mark – a stamp not a label, or a sign, etc.*

*Calquing* is a special kind of borrowing: we borrow from a foreign language a syntagm and literally translate the elements that compose it. For example: *the word 'superpower' is translated, using the method of calquing as a 'power house'*, other examples are as follows *point of view, high voltage, air conditioned, etc.*

*Literal translation* is to transfer the structure of the sentence without changing the construction and without substantial changing the word order. If the Russian sentence has a structure similar to the English one and it can be used without violating the grammar rules and reasoning, the literal translation is acceptable. For example:

*bolt of lightning – lightning strike not lightning flash,  
main – primary not manifold,  
line – a string not pipe, etc.*

#### *Indirect translation methods*

*Transposition* refers to the method, which consists in replacing the words in one language without changing the meaning of the sentence in the second language. Replacement is often necessary because of the different grammatical structures in the

language. The translator shall use the method of transposition, if the resulting pattern matches better the whole phrase or allows you to restore the stylistic features. For example:

“...to enhance the international nuclear power safety measures for civic scientific reactors.” – “...совершенствование международных усилий по обеспечению атомной безопасности относительно гражданских научно-исследовательских ядерных реакторов.”

*Modulation* is a variation of the message, using a phrase with the different meaning in the original language and the target language for the transfer of the same idea. This method can be resorted when it is clear that literal translation or even transposition results in a grammatically correct statement, which is not contrary to the spirit of the target language. Inadequate translation can be avoided through modulation. For instance:

“...which provide the extensive foundation for assuring reactor safety.” – “...формирующие исключительную основу по обеспечению безопасности функционирования реактора.”

In addition to modulation, *concretization* method is widely used in translation, i.e., the translator uses a narrow meaning, belonging to a word, but does not provide a new, as in modulation. For example:

“...according to the operable codes.” – “...согласно действующим сводам положений.” The word ‘codes’ stand for ‘кодекс’, but it has got another meaning such as ‘свод’, for example, ‘свод законов.’

*Equivalence* often occurs that two texts describe the same situation through very different stylistic and structural means. Most of equivalences are stable and are part of the idiomatic phraseology, including clichés, sayings, adjectival or substantive fixed patterns and so on, e.g.,

*dog bolt* – откидной болт,

*cast iron* – чугуун,

*pin* – штилька,

*liquid rockets* – ракеты на жидком топливе, etc.

Quite often is used a translation method called *grammatical replacement*, which can be seen at the level of word forms or the whole sentences, e.g.,

“...that would clearly set the preferable attributes for safety control of a scientific reactor.” – “...однозначно определяющего необходимые атрибуты для контроля за безопасностью научно-исследовательского реактора.” A verb ‘would set’ is translated as a participial phrase ‘определяющий’.

*Compensation* is used when some semantic elements and stylistic peculiarities can’t be transferred reliably. The translator shall remember that the translation is not just the transfer of words from one language to another, it’s also transfer of cultures. For example:

*a boghtrotting son of a bloody noun* – такой-рассякой,

*clunker* – развалюха, etc.

*Adaptation*. When the situation in the original language does not exist in the target language, it shall be transferred through a different situation, which we consider an equivalent, e.g.,

“Nature asked both candidates” – “Журнал “Nature” задал вопросы обоим кандидатам”,

“Department of Energy people” – “представители министерства энергетики США”,

“Safety posters and signs are displayed in the territory of Power Station” – “На территории ТЭЦ развернута наглядная агитация по технике безопасности”, etc.

## 4 Conclusions

This paper discusses the issues and methods of professional translation of scientific and technical papers by the example of power engineering from a linguistic point of view. Translation of technical documents is the field of professional translation activity. The professional translation shall be performed by highly qualified personnel, commanding a foreign language, professional knowledge, specific terminology, being able to adequately and competently express their thoughts in the target language. phrases.

Specific requirements for the scientific and technical translation are the ability to suggest accurate terminology equivalents, which is a necessity for adequate translation. Rather serious issue in the translation of scientific and technical texts is the problem of non-equivalent terms. The origin of non-equivalent vocabulary is differences in the realias of scientific environment. In this case, most of the non-equivalent terms can be translated by calquing, using the lexical and grammatical transformations. Another translation issue is when one English term corresponds to several terms of the Russian language. In this case, the translator requires not only a high enough level of native language and standard of speech, but also deep knowledge in the field the document to be translated refers to.

## References

1. E.S. Tarasova, MJSS **6**, 350 (2015)
2. Yu.I. Lashkevich, M.D. Grozdova, *On the translation of scientific and technical texts* (Practica, Moskva, 2016)
3. V.S. Gorbunova, S.V. Sbotova, XXI century: the results of past and present problems **2**, 194 (2015)
4. A.V. Kartashova, Bulletin of Siberian Science **1**, 617 (2011)
5. D.L. Matukhin, E.N. Gorkaltseva, MJSS **6**, 525 (2015)
6. A.V. Obskov, S.I. Pozdeeva, D.L. Matukhin, G.A. Nizkodubov, MJSS **6**, 319 (2015)
7. Yu. Kobenko, E. Tarasova, Procedia Soc. Behav.Sci. **206**, 3 (2015)
8. Ju. Kobenko, A. Ptashkin, MJSS **5**, 1694 (2014)
9. Y.V. Kobenko, N.N. Zyablova, S.I. Gorbachevskaya, MJSS **6**, 494 (2015)