

ADEQUACY AND EQUIVALENCE OF THE TEXTS TRANSLATED VIA MACHINE TRANSLATION SYSTEMS

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ABSTRACT

The article is devoted to the problem of adequacy and equivalence of the texts translated via machine translation systems. The purpose of the study is to analyze existing machine translation technologies, identify the main errors in the translation of the texts of various subjects, and select the translator which does the highest quality translation of various thematic texts. Two main machine translation technologies have been in focus of the research: a rule-based translation technology (Rule-Based Machine Translation, RBMT) and a statistical translation technology (Statistical Machine Translation, SMT). It has been found out that each technology has both advantages and disadvantages. Among all the studied translation systems, namely Translate.ru (PROMT), Trident Software (Pragma), SYSTRANet, Babylon, Google Translate and Yandex.Perevod, Yandex has proved to be the most successful to complete the translation task regardless of the subject of the translation. Furthermore, it translates various lexical units quite well and confidently copes with grammatical constructions. As it has been found out, Google Translate is inferior to Yandex in the translation of lexical units, especially thematic ones, but has almost the same indicators regarding grammatical correctness. In the third place is the PROMT translator, which translates grammatical constructions well, but has problems with translating thematic vocabulary. The conclusion that can be derived from the research is that we have the most reason to advise Yandex.Perevod to use for translating the texts of different subjects. Despite of the fact that a genuine solution to the problem of machine translation has not yet been found, the development of new scientific theories, modern achievements in the field of Computer Science, Programming, and Linguistics give hope that it will be possible to satisfactory solve this task in the immediate future.

KEYWORDS: *Computer Technologies, Translation Quality, Machine Translation, Computerized Terminological Base, Translation Process.*

1. ACTUAL VALUE OF THE PAPER AND TARGETSETTING.

Machine translation (MT) is actively used in various fields of human activity. Using MT it is possible to understand the contents of large volumes of texts quickly, that is impossible with the traditional approach. Of course, people often want to grasp the essence of the text being translated, without its careful editing, but the development of international relations and business requires higher quality of translation. Nowadays, market offers a large variety of machine translation systems, but only a few organizations and employees use such systems in their daily activities. In the article, the

authors tried to find out the cause of this phenomenon: either it is the imperfection of machine translation systems, or the inability to work with these systems. The authors consider the accuracy and quality of the texts on different subjects translated by the machine translation systems, taking into account the grammatical and lexical structures of both the source and the translating languages.

2. THE PURPOSE AND OBJECTIVES OF THE STUDY.

The purpose of the study is to analyze existing machine translation technologies, identify

the main mistakes in the translated various subjects texts, and select the translator which does the highest quality translation of various thematic texts. The following tasks should be completed to achieve the purpose:

- to analyze the basic technology of machine translation;
- to define the criteria for selecting translators to be tested;
- to make lexical, grammatical and thematic analysis of the translated texts;
- to evaluate the translation quality;
- to determine the difference between machine translation and manual translation.

3. INTRODUCTION.

The idea of creating automatized translations was born at the same time as the first computers appeared. 1954 is considered the year of birth for machine translation: this was the year when the first public demonstration of computer assisted

The first computerized terminological base appeared in the 1960s as required by the European Coal and Steel Community. In terms of their translation technique, the first generation systems were very close to word-by-word translation: each word or speech pattern in the source text was given

The second generation of machine translation systems developed in the mid 1960s-1970s. Their internal organization was more complicated than the first one's: instead of word-by-word translation, an individual syntactic structure was build for each specific sentence, which was based on the input language grammar. After that the structure was transformed into the syntactic structure of the output language and only then the word from the dictionary was substituted, e.i. the synthesis of the sentence in the target language occurred. At this stage, both the morphological and syntactic analyses were used in the machine translation, which significantly improved the quality of the text at the output. Challenges related to semantics, however, remained. Thus, the next stage of machine translation development falls into the 1980s, when the first systems of a semantic type appear. This class includes the systems of machine translation based on the Meaning – Text Theory. This theory creates a multilevel model, which allows to proceed from the text to its meaningful structure written in a certain universal language, after which a reverse transfer from the written meaningful structure to any natural language occurs. That is, a text that can be translated by a computer must be written in a

translation took place. This historical event is known as Georgetown experiment commemorating the name of the University, which participated in the experiment preparation together with IBM. The essence of the experiment was as follows: 60 sentences in Russian written on perfocards were given at the input, while the computer produced the English translation of these sentences at the output. The choice of the source language was stipulated by the beginning of the cold war and the pressing necessity to analyse huge volumes of data incoming in the Russian language. The topic of the translation was relatively narrow – petrochemistry, and all the input sentences were very simple. Under these conditions, the experiment turned out to be quite successful, moreover, the task of machine translation was supposed to be solved within the next five years. Although, the following years of research proved that the issue of machine translation is much more complicated and multidisciplinary than it had been expected.

an equivalent in the target language as it appeared in the dictionary. The first generation systems were not able to solve the issue of polysemy, did not carry out any linguistic analyses, which resulted in quite a low quality of translation.

way that the computer can understand: there must be no ambiguity, and it must contain only terms contained in the computer's dictionary and which always have the same meaning.[1].

The transfer from the text to the meaning and back does not happen directly, but in a number of stages. Six levels of representation are identified within this transfer. The pole levels are semantics and phonetics, while the intermediate ones include deep and surface syntactic representation and deep and surface morphological representation. The semantic level of representation is described by a graph, while syntactic levels are implemented through a dependency tree and finally the morphological one is a linear structure. In spite of its universal character and the whole potential of the theory in general, its application in the machine translation systems has not given any significant quality advancement yet. Dozens of years of research in machine translation showed how great are the difficulties in transferring from a natural language to the universal metalanguage.

Besides, worth mentioning is the rise of the interactive systems of machine translation, which require human interference at different stages of translation[2], [3], [4], [5].

Such interference can be implemented in the following forms:

Post-editing: a human edits the text translated by the machine.

- Pre-editing: a human edits the input text adjusting it for an easier understanding by a machine.
- Partially automated translation: a human and a machine interact in the process of translation. For example, the usage of electronic dictionaries by the humans in the process of translation; a human's participation in the machine translation to solve difficulties.
- Mixed systems: for example, those including post- and pre-editing.

Throughout the years, the systems of machine translation have undergone significant changes. Today the number of machine translation services is really great.

There are two main machine translation technologies: rule-based (Rule-Based Machine Translation, RBMT) and statistical (Statistical Machine Translation, SMT). In the first one, in order to receive a translation, well-known language rules implemented in the form of linguistic algorithms are applied to the text. The statistical technology does not use such algorithms: it gradually "learns" the language by comparing thousands of parallel texts, that is, texts containing the same information, but in different languages, and selecting the most likely translation option on this basis.

Let us consider these technologies in more detail.

The rule-based translation process can be divided into several stages.

1. *Morphological analysis*: the gender, number, person and other morphological characteristics of the words are indicated. In this case, the problem of ambiguity arises: the same word can refer to different parts of speech. For instance, the English word "bottom" can be used as a verb (in the meaning of "to ground", "to touch the bottom", "to get to the bottom"), as a noun (in the meaning of "end", "reason", "bed", "underworld") and as an adjective (in the meaning of "lower", "last", "main"). At this stage, all translation options are recorded.

2. *Individual words are grouped*. For example, the group "many nice books" consists of the quantitative word "many" for the plural, the adjective "nice" and the plural noun "books". This allows solving the problem of grammatical

ambiguity and removing some "extra" meanings of words.

3. *The syntactic analysis of sentences*, that is, the definition of the sentence members and their place in the sentence. First, the program searches for the predicate. Then, the subject is searched before the found predicate. If it is absent, then the algorithm searches for the subject after the predicate. If there is no subject there, then it is considered that the subject is absent, as is the case, for example, in impersonal sentences ("It snows.").

4. The coordination of the found parts of sentences and groups of dependent words is *a synthesis of sentences*.

A similar approach to translation is used in the SYSTRANet services of SYSTRAN and Translate.Ru of the Russian company PROMT.

Until 2006, the use of rules was the only way of machine translation, when the Google Translate service appeared, based on a different - statistical - approach to translation.

To operate effectively, **the statistical translation system** needs an extensive database of parallel texts. The sources of such texts may be multilingual versions of various organizations' websites, for example, a database of EU documents. At the same time, for the correct work of the translator, it is necessary to have a huge number of parallel documents in the database.

It is not surprising that the first available statistical translator was the service of the largest online search engine – Google. Soon, competitors followed: Bing with Microsoft Translator and Yandex with Yandex.Perevod.

The latter system, according to the developers, consists of three main parts: a translation model, a language model, and a decoder.

A translation model is a table in which, for all words and phrases in one language known to the system, all possible translations into another language are listed and the probability of these translations is indicated. The translation model is created in three stages: first, parallel documents are selected, then the pairs of sentences in them, and finally, the pairs of words or phrases.

The second component of the machine translation system is *the language model*.

To create it, the system studies hundreds of thousands of different texts in the desired language and compiles a list of all the words and phrases used in them, indicating the frequency of their use. A language model is a representation of knowledge of the system of the language into which the text is to be translated.

The third component of the translator, *the decoder*, is directly involved in the translation. For each sentence of the source text, it selects all translation options combining phrases from the translation model and sorting them in the descending order of probability. Then the decoder evaluates all the resulting options using the language model.

For example, a user wants to translate the phrase “to be or not to be”. Let us suppose that of all the variants of its translation in the translation model, the combination of “быть или не бывает” has the maximum probability, and then comes in a close second the combination of “быть или не быть”, etc. After the translation model, the decoder turns to the language model, which says that “быть или не быть” is used more often than to “быть или не бывает”. As a result, the decoder selects the sentence with the best combination of probability (in terms of the translation model) and frequency of use (in terms of the language model).

Each technology has its pros and cons. A rule-based translation system usually produces a more or less coherent translation, through which the user can guess the meaning of the text. The system has customization options for translating texts with specialized terminology, in particular, the ability to connect to thematic dictionaries.

The statistical translation system is perfect for translating stable phrases. Such systems are quite flexible: if something changes in the language, for instance, people start writing a word in a different way, and then the system notices this as soon as new texts get to it. On the other hand, a “statistical” translation of the same term may turn out to be different depending on the context, which is not always desirable. At the same time, rule-based technology can provide the same translation of the same term.

The quality of the “statistical” translation directly depends on the volume and versatility of the parallel text database.

Often there are not enough such texts and translation between languages supported by the system is done through an intermediate translation into English. There are languages that go through a double translation process. For example, translation from Belarusian and Ukrainian languages is first carried out into Russian, then into English, and only then into the target language. This can be seen by comparing the direct translation and the translation performed in the specified ordered chain. However, this situation may well change when a sufficient base of parallel texts is accumulated.

Freely available online machine translation (MT) tools, such as Google Translate and Microsoft Translator, use statistical translation models trained from a large amount of text data in the relevant languages. The quality of MT tools has improved steadily over the last few years, but these tools are not error free. Moreover, MT tools are often better at translating generic text, such as news articles, than translating domain-specific text containing specialized vocabulary [6]. Thus, there is concern that the quality of MT alone might not be sufficient [7], [8], [9], [10]. Evidence indicates that MT combined with human postediting produces a quality product.

The problem of automatic testing has been considered in many papers [11], [12], [13], [14], [15].

All this suggests the combination of the advantages of both technologies. Indeed, PROMT acquired parallel databases from Google (the body of texts is over 24 GB in a compressed form) and at the end of 2010 introduced a hybrid translation technology.

The essence of such a combination is that instead of one translation option, the program generates many options, the number of which in one sentence depending on the polysemy of words, constructions and results of statistical processing, can reach several hundred. Further, a probabilistic language model allows choosing the most probable option from the proposed ones.

In order to improve the quality of translation, online translators are updated on a regular basis. Each update is tested first. For this, an algorithm for evaluating the quality of machine translation is used. The algorithm is called BLEU (Bilingual Evaluation Understudy): the translation of specially selected texts received by the system is compared with the reference one, and if the data from the newly studied documents worsened the quality of the translation, they are rejected. Various methods for the evaluation for machine translation have been employed. BLEU was one of the first metrics to report high correlation with human judgments of quality. The metric is currently one of the most popular in the field. The central idea behind the metric is that “the closer a machine translation is to a professional human translation, the better it is” [16].

A number of services organize feedback with the user: he can offer his own version of the translation (Google Translate and Translate.Ru) or approve / condemn the translation performed by the system (Bing). However, such an approach, with all its attractiveness, can, on the contrary, lead to a

deterioration in the quality of translation due to the low qualification of volunteer assistants. It is believed that MT can be useful for particular types of technical documentation. However, the efficiency of MT, be it Google Translate or any other expensive program, is therefore basically determined by the quality and the volume of the specialized dictionaries that the program comprises [17].

Typically, machine translation systems are checked before launching, either using special algorithms or manually by people. In the second case, checking, even if it is slower, allows evaluating the quality much better.

Nevertheless, even such a check generally takes place at the level of sentences, and much less often at the level of the text, which may affect the coherence of the whole text and, as a result, its understanding by the reader. The most common standard for comparing translations is probably quality, a notion that itself requires definition. If we follow the insights of TS, quality cannot be an absolute notion, but must be related to purpose and context [18].

The Department of Foreign Languages at O.M. Beketov National University of Urban Economy in Kharkiv, Ukraine, carried out an

experiment to evaluate the quality of machine translation and recommend a translation service for translating the documents in a variety of topics. The focus was mainly placed on linguistic and semantic analysis. The research was carried out in cooperation with the University's Canadian partner institution INSITU Language School, Quebec, which specializes in training French speaking government officials for English language exams. The Canadian partners were responsible for selecting the proper source texts in English, while the researchers from the Ukrainian University carried out the translation analysis of the target texts in Ukrainian.

Currently there are dozens of online translation platforms. We have chosen six services supporting the Russian language: PROMT (Russia), Trident Software (Pragma) (Ukraine), SYSTRAN (France), Babylon (Germany), Google Translate (USA) and Yandex.Perevod (Russia). The following criteria were applied in choosing the translation platforms: number of symbols to be translated, availability of the built-in dictionary, possibility to translate the text directly from the file, availability of samples, possibility of automatic language identification, possibility to edit the translation and to choose the topic of the text to be translated.

	Translate.ru (PROMT)	Trident Software (Pragma)	SYSTRANet	Babylon	Google Translate	Yandex.Perevod
Translation of over 3000 symbols	+	-	-	+	+	+
Built-in dictionary	+	-	+	+	-	-
Translation directly from the file	+	-	+	-	+	+
Translation samples	+	-	-	-	-	-
Automatic language identification	+	-	+	-	+	+
Translation editing option	+	-	-	-	+	+
Choice of topics	+	+	-	-	-	-

Thus, Translate.ru (PROMT) can translate up to 3,000 symbols, has a built-in dictionary, a choice of contexts, uses about 20 topics. Besides, it has the function of checking the spelling, translation editing and printing, the function of saving the translations is also available.

Trident Software (Pragma) works only with 5 topics, but can build in a program and has a function of saving translations. Specializes in Slavic languages, but generally supports 56 languages, including the exotic ones.

SYSTRANet can translate up to 2,000 symbols, offers an alternative variant of translation, which is definitely an advantage.

Babylon can a built-in dictionary, as well a thesaurus and can be integrated into browsers.

Google Translate can translate up to 5,000 symbols. When translating separate words, it automatically shifts into an online dictionary mode. Google Translate's distinctive feature is vocalization and hand-written input. Another useful function is the availability of transcription and transliteration.

Yandex.Perevod provides translation of up to 10,000 symbols, supports both voice and text input, is capable of translating texts from pictures. This translator has a function of spelling checking in the source text and the option of saving translations.

There are some machine translation evaluation survey works, where people introduced more details about what kinds of human evaluation methods they used and how they work, such as the intelligibility, fidelity, fluency, adequacy, comprehension and informativeness, etc. For automatic evaluations, they also did some clear classifications such as the lexical similarity methods, the linguistic features application, and the sub fields of these two aspects. For instance, for lexical similarity, it contains edit distance, precision, recall and word order; for linguistic feature, it is divided into syntactic feature and semantic feature respectively [19], [20].

To evaluate the quality of translation, we used no-fee online translators. Six popular servers have been tested in order to identify, which of them is the best in terms of fulfilling its functions.

For testing the quality of translation from English into Russian, three texts of various topics have been chosen. The choice of topics is connected with the need to translate big volumes of texts in the area of economics and transportation for the correspondent University departments. The translations were assessed both in terms of the

ability to identify the topic and correct translation of lexical units, as well as in terms of the correct translation of grammar patterns. The first text was an abstract from an article called *The latest in high-speed train technology*, published in *Machine Design* journal in November 2011 года. It deals with the railway area. The second text is a sample of a bell-lettre text *The interesting most boring man in the world*, offered by the British Council for the learners of English. And the third one is an abstract from the article called *The Economy Is Expanding. Why Are Economists So Glum?*, that was published in *The New York Times* released on the 8th of January, 2020. Sure enough, this kind of testing is far from the level provided by the BLEU methodology, but even it can offer useful information for consideration.

4. RESULTS.

The first abstract included railway terminological units and simple grammar patterns. We compared original text with the translations made by different translators. The first translation was made by PROMT translator.

Original text	Translation by PROMT
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>В комплекте поездов, в который входят все пассажирские вагоны, имеется ездовой вагон. Это ведущий вагон и отличается наклонным, аэродинамическим носом и относительно небольшим отсеком в передней его части для размещения лобового стекла, органов управления и аппаратуры связи, а также машиниста, единственного человека, действительно необходимого для вождения поезда. Остальная часть движущегося автомобиля оборудована для пассажиров.</i>

As the result PROMT identified the topic, but made mistakes in the translation of lexical units. Unfortunately, shifting the topic did not improve the quality of translation. There were not problems with grammar and case agreement.

Translation made by Pragma:

Original text	Translation by Pragma
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>Набор поезда, который включает все легковые автомобили, имеет двигающийся автомобиль. Он является свинцовым автомобилем и изображает наклоняют, аэродинамический нос и относительно маленькое купе на фронте этого, чтобы приспособить ветровое стекло, управления, и аппаратуру связи, также как и водителя, только person действительно нужно было управлять поездом. Остальная часть двигающегося автомобиля снаряжается для пассажиров.</i>

Pragmatically confused the topics and the parts of speech. However, it didn't have any critical problems with pronouns and cases. The word *person* has been translated.

The next translation was made by SYSTRANet.

Original text	Translation by SYSTRANet
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>В комплекте, включающем все пассажирские вагоны, имеется автомашина. Это головной автомобиль, на котором имеется изрезанный аэродинамический нос и относительно небольшой отсек спереди, чтобы разместить ветровое стекло, элементы управления и оборудование связи, а также водитель, единственный человек, действительно необходимый для управления поездом. Остальная часть автомобиля оборудована для пассажиров.</i>

SYSTRAN tried to identify the topic, but eventually made a mistake. It had small problems with translation of lexical units. However, no critical problems arose with grammar and case agreement.

Translation made by Babylon:

Original text	Translation by Babylon
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>Поезд, который включает в себя все легковые автомобили, вождение автомобиля. Она является ведущей машине и имеет пологий, аэродинамический носом и сравнительно небольшой отсек в передней части она на лобовое стекло, элементы управления, и коммуникационного оборудования, а также драйвера, единственным человеком, действительно необходимо ехать на поезде. В движущемся автомобиле установлена утилита для пассажиров.</i>

Babylon has not completely managed the translation. It has not identified the topic, wrongly translated a big amount of words, cases and parts of speech have not been agreed, pronouns have been confused.

Translation made by Google:

Original text	Translation by Google
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>Поезд, который включает в себя все пассажирские вагоны, имеет вагон. Это ведущий вагон, с наклонным аэродинамическим носом и относительно небольшим отсеком в передней части для размещения ветрового стекла, органов управления и коммуникационного оборудования, а также водителя, единственного человека, который действительно нуждается в управлении поездом. Остальная часть вождения автомобиля оборудована для пассажиров.</i>

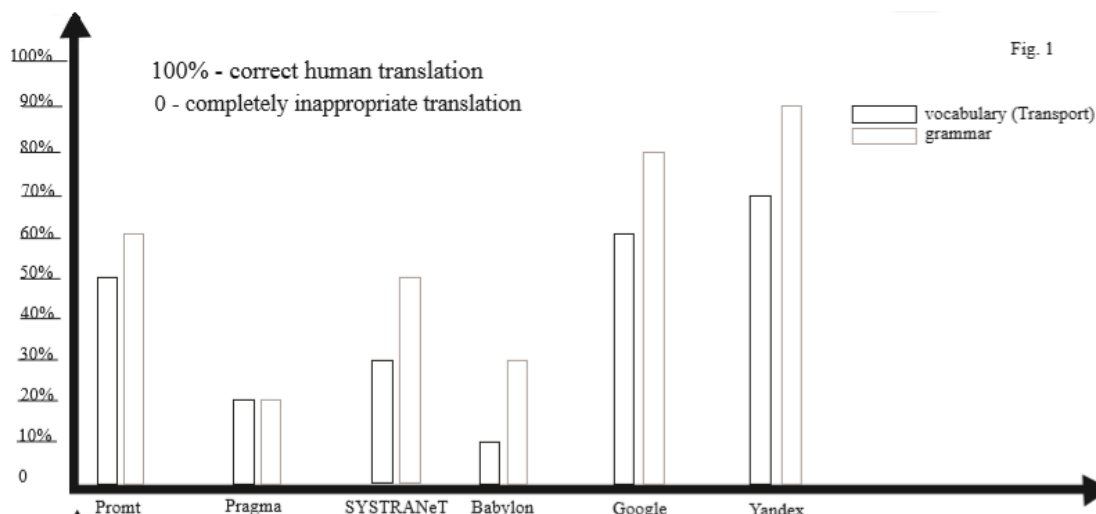
Translation made by Yandex:

Original text	Translation by Yandex
<i>The train set, which includes all the passenger cars, has a driving car. It is the lead car and features a sloped, aerodynamic nose and a relatively small compartment at the front of it to accommodate a windshield, the controls, and communication equipment, as well as the driver, the only person really needed to drive the train. The rest of the driving car is outfitted for passengers.</i>	<i>В поезде, который включает в себя все пассажирские вагоны, есть водительский вагон. Это головной вагон с наклонным аэродинамическим носом и относительно небольшим отсеком в передней части для размещения лобового стекла, органов управления и коммуникационного оборудования, а также водителя, единственного человека, действительно необходимого для управления поездом. Остальная часть автомобиля оборудована для пассажиров.</i>

Google and Yandex correctly identified the topic, but changed it in the last sentence. Both translators managed the translation of grammar patterns and case agreement well enough. However,

Google made a mistake when translating the tense and omitted the word *driving* which was the key one.

The table shows that Yandex.Perevod has been the best to deal with a technical translation, construcitons, suchastenses, successiooftenses, impersonalclauses, as well as quite simple lexical



both in terms of lexical units translation and the translation of grammar patterns. The first translation was made by Promt translator.

The second abstract was the one from a belle-lettre text and included complicated grammar

Original text	Translation by PROMT
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Люди часто говорили, что Тьерри Бойл был самым скучным человеком в мире. Тьерри не знал, почему люди считают его таким скучным. Тьерри считал его довольно интересным. Ведь он собирал марки. Что может быть интереснее марок? Правда, других увлечений или интересов у него не было, но для Тьерри это не имело значения. В конце концов, у него была работа.</i>

PROMT got a little bit lost in the succession of tenses and translation of pronouns, while it had no problems with translating lexica units, including proper names.

A mistake in the succession of tenses was also made by Pragma:

Original text	Translation by Pragma
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Людичастогоговорили, что ThierryBoyle является больше всего скучным мужчиной в мире. Thierry не знал, почему люди думали, что он такой занудливый. Thierry думал, что он является quite интересуется. В конце концов, он собрал марки. Что смогло быть больше интересуется, чем марки? Это было верно, что он не имеет любых других хобби или интересов, но это не имело значения для Thierry. Он имел свою работу, в конце концов.</i>

The grammar patterns were misunderstood by the translator. Besides, it made critical mistakes when translating lexical units and parts of the speech, did not agreed the latter. Pragma was the only translator out of six, which did not manage to properly translate a proper name. The word *quite* remained untranslated.

The next translation was made by SYSTRANet.

Original text	Translation by SYSTRANet
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Людичастоговорили, чтоТьерриБойлбылсамымскучнымчеловекомвмире.Тьерринезнал, почемулюдидумали, чтоонтакойскучный.Тьеррисчиталегодовольноинтересным.Вконцеконов, онсобиралмарки.Чтоможетбытьинтереснеемарок?Этоправда, чтоунегобылодругиххоббиилиинтересов, ноэтоимелозначениядляТьерри.Вконцеконов, унегобыларбота.</i>

SYSTRAN did not take into account the succession of tenses and incorrectly translated the pronoun. The translation of the impersonal sentence also caused difficulties. At the same time no critical problems arose when translating lexical units.

Translation made by Babylon:

Original text	Translation by Babylon
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Люди часто говорят о том, что Тьерри Бойл был самый скучный человек в мире. Тьерри не знаю, почему люди думали, что он был так скучно. Тьерри думали, что он был довольно интересным. В конце концов, он собирал марки. Что может быть более интересным, чем почтовые марки? Верно, что он не есть какие-то другие хобби или интересы, но это не имело значения для Тьерри. У него задание, после всех.</i>

Babylon got lost in the succession of tenses, incorrectly translated parts of the speech and made critical mistakes when translating lexical units.

The next translation was made by Google:

Original text	Translation by Google
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Люди часто говорили, что Тьерри Бойл был самым скучным человеком в мире. Тьерри не знал, почему люди думали, что он такой скучный. Тьерри подумал, что он довольно интересный. Ведь он собирал марки. Что может быть интереснее, чем марки? Это правда, что у него не было никаких других увлечений или интересов, но для Тьерри это не имело значения. В конце концов, у него была работа.</i>

Google Translate left the succession of tenses beyond its attention. However, no problems arose with translating parts of speech and lexical units.

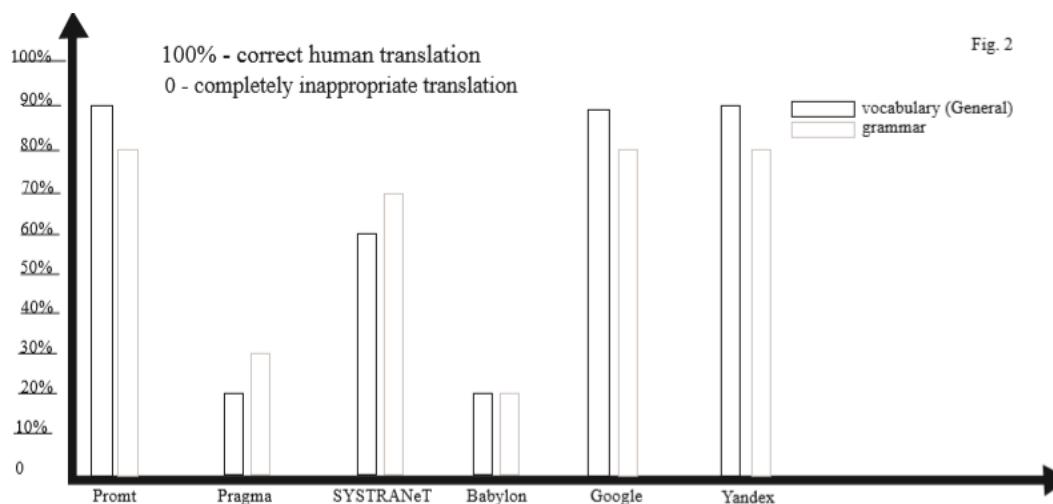
The last translation was made by Yandex:

Original text	Translation by Yandex
<i>People often said that Thierry Boyle was the most boring man in the world. Thierry didn't know why people thought he was so boring. Thierry thought he was quite interesting. After all, he collected stamps. What could be more interesting than stamps? It was true that he didn't have any other hobbies or interests, but that didn't matter for Thierry. He had his job, after all.</i>	<i>Люди часто говорили, что Тьерри Бойль-самый скучный человек на свете. Тьерри не понимал, почему люди считают его таким скучным. Тьерри подумал, что он очень интересный человек. В конце концов, он коллекционировал марки. Что может быть интереснее марок? Правда, у него не было других увлечений или интересов, но для Тьерри это не имело значения. В конце концов, у него есть работа.</i>

Yandex perfectly coped with these task. The translation of grammar patterns did not cause any difficulties. There was just one mistake made by Yandex in translating a lexical unit.

As can be seen from the figure 2, Yandex showed the best results, both in the translation of vocabulary and in the translation of grammatical patterns. The translators Translate.ru and Google Translate

were close second. The translator Translate.ru did well in translating vocabulary, but did not do well with grammar. Google Translator was a bit inferior in translating vocabulary, but it was better at grammar.



In the third fragment emphasis was placed on economic topics, grammatical constructions consisted of complex sentences, which included participles and gerund.

Original text	Translation by PROMT
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Сокращение, и в меньшей степени дополнительные расходы, помогли подтолкнуть дефицит федерального бюджета почти до \$1 трлн в год, несмотря на то, что безработица сохраняется около полувекового минимума. Бюджетный дефицит остается высоким в ряде других богатых стран, особенно с учетом того, насколько далеко находятся эти страны в процессе экономического роста. Процентные ставки снижаются в развитых странах благодаря длительным тенденциям, таким как старение населения. Это оставляет центральные банки - которые обычно стимулируют рост, делая заимствования дешевле - с гораздо меньшей обычной властью в рецессии.</i>

PROMT translator identified topics, but made small mistakes in translating vocabulary. The translator coped with the grammar quite well.

Translation made by Pragma:

Original text	Translation by Pragma
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Разрезы, и к меньшему градусу дополнительный расход, имеют помог толкают государственный бюджетный дефицит приблизительно к \$1 триллиону год, даже, так как безработица засиживается возле half-сентигу низко. Бюджетные дефициты остаются высоко в некотором количестве другие богатые нации, особенно данные, как далеко в экономическом процветании те страны есть. Процентные ставки капаят через передовые экономики, спасибо к захотеть-текущим тенденциям подобно старению населения. Это оставляет центральные банки - который обычно stoke рост, создавая заимствование дешевле - с далеким менее обусловленная мощность в спаде.)</i>

Pragma showed the worst results both in terms of vocabulary and grammar. It tried to recognize the topic, but incorrectly translated the vocabulary, the words “half-century” and “stoke” remained untranslated. In terms of grammar, the following mistakes were observed: inconsistency of parts of speech, non-recognition of Perfect Tense, disturbed word order in a sentence, complete mismatch of grammatical constructions.

Translation made by SYSTRANet:

Original text	Translation by SYSTRANet
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Сокращения и в меньшей степени дополнительные расходы помогли довести дефицит федерального бюджета до почти 1 триллиона долларов в год, даже несмотря на то, что уровень безработицы остается на уровне, близком к полувековому уровню. Бюджетный дефицит остается высоким в нескольких других богатых странах, особенно учитывая, насколько далеко они продвинулись в экономическом развитии. Процентные ставки падают в развитых странах благодаря долгосрочным тенденциям, таким как старение населения. В результате центральные банки... которые обычно замедляют рост, делая займы дешевле — с гораздо менее традиционной властью в рецессии.</i>

SYSTRANet recognized economic topics and quite successfully coped with the translation of vocabulary. However, the translator had no problems translating grammatical constructions.

Translation made by Babylon:

Original text	Translation by Babylon
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Разрезы и в меньшей степени дополнительных расходов, помогли push дефицит федерального бюджета до почти \$1 трлн. в год, даже несмотря на то, что безработица сохраняется почти полвека. Бюджетного дефицита по-прежнему остается высоким, и в ряде других богатых стран, особенно с учетом того, насколько далеко в экономического роста этих стран. Процентные ставки были падая в странах с развитой экономикой, благодаря длительной тенденции, как старение населения. О том, что листья центральных банков (что обычно сток роста путем заимствования дешевле - с гораздо менее традиционных источников в рецессии.</i>

Babylon translator tried to recognize the subject matter, but ended up translating the vocabulary incorrectly. As well as Trident, it did not completely cope with all the grammatical constructions, thus showing the same negative result as Pragma.

Translation made by Google:

Original text	Translation by Google
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Сокращения и, в меньшей степени, дополнительные расходы помогли довести дефицит федерального бюджета почти до 1 триллиона долларов в год, даже несмотря на то, что уровень безработицы приближается к полувековому минимуму. Бюджетный дефицит остается высоким в некоторых других богатых странах, особенно с учетом того, насколько далеко эти страны находятся в экономической экспансии. Процентные ставки снижаются в странах с развитой экономикой благодаря таким долговременным тенденциям, как старение населения. Это оставляет центральным банкам, которые обычно стимулируют рост, делая заимствования более дешевыми, с гораздо меньшей условностью в условиях рецессии.</i>

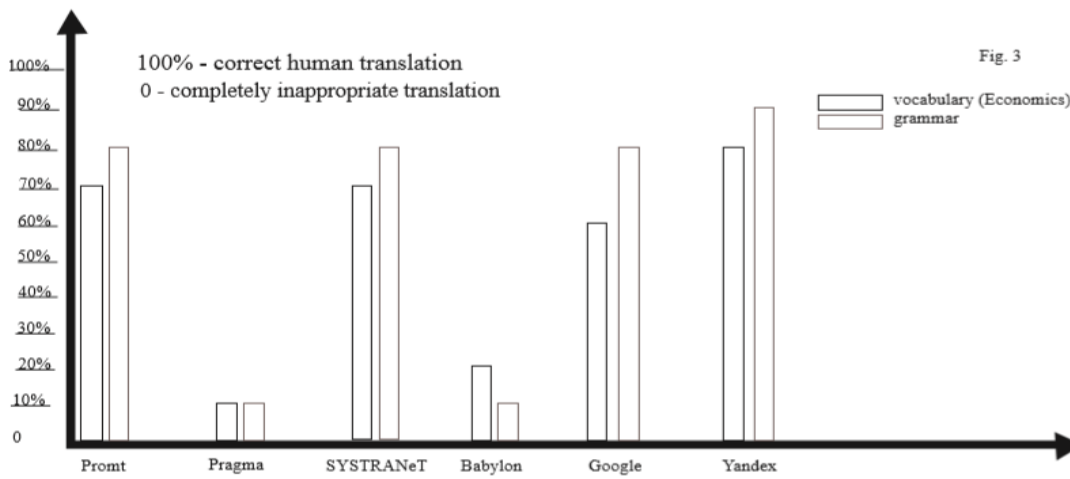
Google Translate did not cope with thematic vocabulary, although it recognized the subject matter. Google Translator had no problems translating grammatical constructions as well.

Translation made by Yandex:

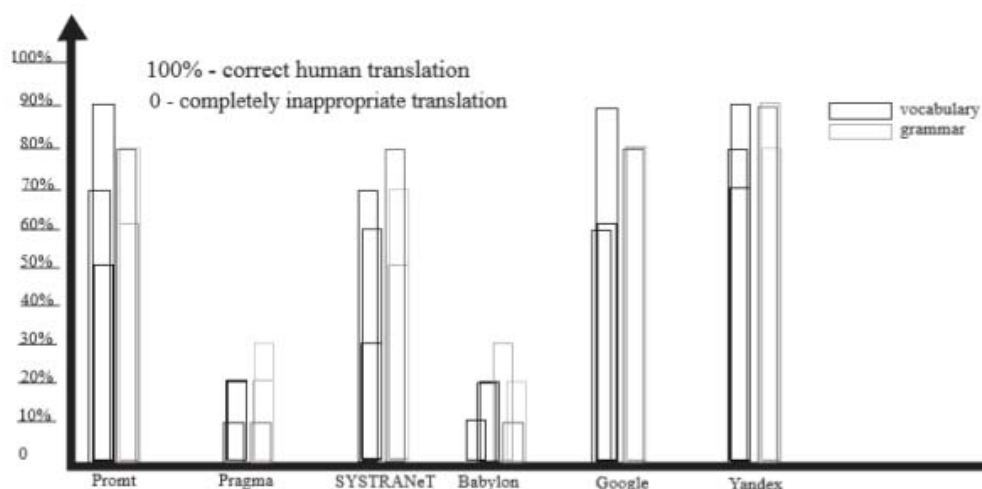
Original text	Translation by Yandex
<i>The cuts, and to a lesser degree the additional spending, have helped push the federal budget deficit to nearly \$1 trillion a year, even as unemployment lingers near a half-century low. Fiscal deficits remain high in several other wealthy nations, particularly given how far into an economic expansion those countries are. Interest rates have been dropping across advanced economies, thanks to long-running trends like population aging. That leaves central banks — which usually stoke growth by making borrowing cheaper — with far less conventional power in a recession.</i>	<i>Эти сокращения и в меньшей степени дополнительные расходы помогли довести дефицит федерального бюджета почти до 1 триллиона долларов в год, несмотря на то, что безработица остается почти на полувековом минимуме. Дефицит бюджета остается высоким в ряде других богатых стран, особенно учитывая, насколько далеко они продвинулись в экономическом развитии. Процентные ставки падают во всех странах с развитой экономикой, благодаря таким долгосрочным тенденциям, как старение населения. Это оставляет центральные банки, которые обычно стимулируют рост, делая заимствования дешевле — с гораздо меньшей традиционной властью в условиях рецессии.</i>

Yandex did an excellent job with both the translation of vocabulary, the definition of topics, and the translation of grammatical constructions.

Unfortunately, none of the translators translated the word “recession”, all of them used transliteration.



5. Outcomes. Based on the above graphs, it can be concluded that, regardless of the subject of the translation, the Yandex translator has been the most successful to complete the task. It translates various lexical units quite well and confidently copes with grammatical constructions. Google Translate is inferior to Yandex in the translation of lexical units, especially thematic ones, but has almost the same indicators regarding grammatical correctness. In the third place is the PROMT translator, which translates grammatical constructions well, but has problems with translating thematic vocabulary.



The authors of the article came to the following outcomes:

1. The quality of the translation depends on the subject matter and style of the source text, as well as the grammatical, syntactic and lexical affinity of the languages between which the translation is made.

2. Machine translation of literary texts almost always turns out to be of unsatisfactory quality. Nevertheless, for technical documents with specialized machine dictionaries and some adjusting of the system to the features of one or another type of texts, it is possible to obtain a translation of acceptable quality, which needs only a small editorial correction. The more formalized the style of the source document, the better quality of translation you can expect. The best results when using machine translation can be achieved for texts written in technical (various descriptions and manuals) and formal business style. Mistakes are caused by the fact that the computer cannot think in images and does not have the ability to operate on the realities of different cultures and eras in the way that the human brain is capable of doing.

3. The lexical analysis of the translated texts showed that the electronic translator copes with the translation of words in the plural and singular, but makes mistakes in the translation of cases, affiliation of adjectives, speech, framing sentences. At the same time, it is worth noting that the main disadvantage of machine translation is its inability to accurately translate words that have several meanings.

4. Grammar analysis of the texts shows that electronic translators adequately translate simple parts of speech, but there is some difficulty to translate cases and to put verbs into singular or plural form. It can be explained by the different

interpretation of cases in Russian and English: in Russian - with the ending, in English - with prepositions.

For more adequate translation in the future, a deeper heuristic analysis of the grammatical construction of the sentence, with an improvement in the quality of the translation of various parts of speech and their grammatical characteristics can be offered as well as to eliminate the conflict of dictionaries when translating specialized texts. For example, the sentence in English "This is my book" literally is translated into Russian as "Это есть моя книга". Although formally it is correct, they do not speak Russian like that. In this case, we can say that the sentence looks like it has been written by a foreigner. Of course, the above example is one of the simplest ones, and the ability to exclude the word "is" is easily reflected in any machine translation program. But in practice, the resulting translation is similar to a text written by a foreigner.

Thus, machine translation differs from human translation in the following ways:

- inability to choose the right word from the group of synonyms;
- inability to correctly and meaningfully choose the ending or preposition;
- not always correct translation of homonyms;
- impossibility of maintaining the lexical and logical connection between sentences;
- inability to preserve the style of the original (source) text in the translated version.

As a result, machine translation almost always requires editing. And how adequate the translation results on a computer can be considered is determined not only by the quality of the machine translation system, but also by the quality of subsequent editing.

The authors of the article do not recommend to use machine translation without subsequent editing by a professional translator to translate contracts, letters of guarantee, marketing materials, medical documents, a mistake in which can cost someone's life. However, these translators are well suited for businesses that need to accelerate intercultural communication processes.

5. CONCLUSION.

Modern computer translation programs are quite good, but they still cannot solve the most difficult task of the translation process: to choose the contextually necessary option, which in every text is due to many reasons. Currently, the result of this type of translation can be used as a draft of the future text which will be edited by a translator, and also as a means to get a general idea of the topic and content of the text in the absence of a translator.

The prospects for the development of machine translation are associated with the further development and deepening of the theory and practice of translation, both machine and human ones. For the development of the theory, the results

of comparative linguistics, the general theory of translation, the theory of natural correspondences, ways of representing knowledge, optimization and improvement of linguistic algorithms are important. Although neural networks already grasp semantic and syntactic connections in sentences and even recognize the speaker's accent, they are not able to take into account cultural, cognitive, literary and other aspects of translation.

Another important task to improve the quality of translation is to train the machine to understand the text as a whole. It is necessary when the machine translates headers, signs, notices and other parts isolated from the context.

There is also the need to connect the special knowledge component to linguistic processors. A genuine solution to the problem of machine translation has not yet been implemented in any project, however, the development of new linguistic theories, modern achievements in the field of machine learning, the development of electronic dictionaries, thesauruses, as well as the progress of computer technology give hope that it will be possible to satisfactorily solve this task in the immediate future.

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