Foundation of the Computer Assisted Translation Act

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ABSTRACT

Mechanical translation (MT) is the transfer of a text from a source language (SL) into a target language (TL) via a cybernetic machine, in other words, "computer". Human labour, human skills, human experience and human brain power are inevitable in this operation.Mechanical translation is based on word-for-word translation. What occurs in mechanic translation can be summarized as the mutual functioning of SL and TL together, and the achievement of coherence and equivalence in the performed translation. The data are given by humans and the translation is "automated" and mechanized by the computer.With the development of computers, mechanical translation has progressed to a more advanced level in recent years. The recent developed technology has put the polysemy of the words as well as the grammar rules at the disposal of humanity with a developed computer for an optimal translation.This study will show the stages of mechanical translations and the working systems of the projects conducted in this field. On the other hand, sentence-for-sentence-translation, which is the point that normal translation has arrived at, renders the mechanical translation more successful and fruitful. In this way, the contextual meaning of the text gets transferred.The current paper is comprised of the titles of The Realization of Natural Language Elements in Computer, Terminology Formation in Mechanical Translation and Actions Occurring in Mechanical Translation, and mechanical translation is tried to be presented and explained through illustrations and the main elements used.

Keywords: *Machine Translation (MT), PC/Computer, Source Language (SL), Target Language (TL), Terminology*

INTRODUCTION

Today's individuals follow the scientific, political, cultural and commercial developments, and watch them with interest. A political or a commercial development in a country could affect the lives of those individuals who are so far away from that country. It is so interesting and important to read or listen a document or a novel that was written in a foreign language in our mother tongue through Machine translation techniques with the help of electronic tools-especially with computer.

Translation which is automatically performed from a human language into another by using computer software and hardware technology is called automatic translation, or machine translation (MT) in general. The function of computer assisted translation (Mechanical Translation) is to ensure that the source text is analyzed by Computer (PC) and synthesized into a target language, that is, to ensure that the source text is translated word for word or sentence for sentence by PC. A Machine translation block between two persons is given in Figure 1. O. Kade, A. Neubert, G. Jaeger from "Leipzig Translation School" have contributed significantly to the works in MT.

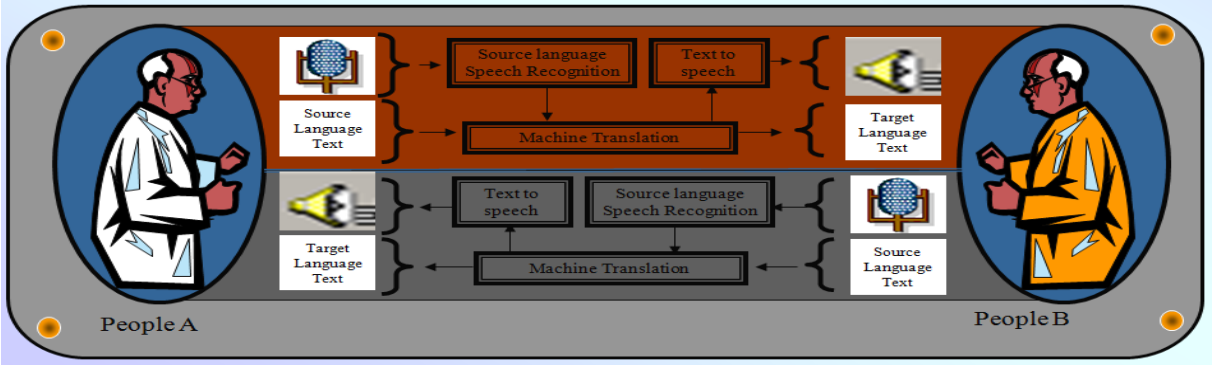

Figure 1.[1] Machine Translation between two persons

There have been many studies conducted on machine translation and the automatication of machine translation. These works began with the invention of computer and progressed in parallel with the development of computer technology. It is 1950's and 1960's that the works on this field boomed. The advancements and successes in those years are limited and unsatisfactory translations were accomplished. The works that began in 1950's continue rapidly and significant achievements have been reached. Still, full automatic translation is yet to be reached and human translation has to be a part of it. On the other hand, the studies are still being carried out on scientific methods to create better and more accurate translations.

What happens in mechanical translation is to ensure that the ST and TT, that is, both languages, function together and create harmony. And that happens with the help and skill of human power. The data are given by the humans and the translation is "automated" - mechanized by the computer. When mechanical translation finds the various meanings of the words belonging to a source text in the target texts, it will succeed in reaching an optimal automatic translation. We cannot say we have accomplished it today. Significant achievements have been reached in a few languages (English, German and French). That level has yet to be reached in many languages apart from them.

Let's have a look at the English and German translations of a Turkish sentence done by the "google translate" program.

„**Üç yıl önce Dubai'de bulundum"**

a.Three years ago **I** was in Dubai (engl-human translation)

b. Vor drei Jahren war **ich** in Dubai gewesen.(german- human translation)

On the other hand:

c. Three years ago **we (I)** have been to Dubai (english - google translation

d. Vor drei Jahren **haben wir (ich)** bereits in Dubai (…) (german -google translation)

There is problem in the perception of pronouns in German and English. "We" should be "I", "wir" should be "ich" and "haben" should be "sein". The syntax is not completely realized in German. While the verb "gewesen" should be at the end, it is not understood in translation. It is revealed here that for a meaningful translation, humans must take part in translation process.

„**Üç yıl önce Dubai'de bulundum**"

(English) Three years ago **I** have been to Dubai: a. ***Üç yıl önce ben dubai olmuştur***. (Turkish)

(German) Vor drei Jahren war ich in Dubai gewesen: b. **Üç yıl önce Dubai'de olmuştu.**

In the Turkish equivalents of the English and German sentences, we are more faced with meaning-based incomprehensibility. Both sentences reflect a meaningless translation. After the translations performed above, the problem is seen as the fact that Turkish is from a different language family (Ural-Altaic language family). As the syntax

[1] This table was firstly used in the article of Oz, C., Leu, MC. (2011) and was taken and modified according to the scope of this study.

structures of the both language families are different, there is a problem in the transfer from ST into TT.

According to the determination of UNESCO, there are 4000 languages in the world and translation is done only between 1200 of them (Ljudskanow:1972:219). Mechanical translation is successful only in a few languages as understood from the illustrations we have seen above and the success is limited to the translations among European languages.

Mechanical translation is based on word-for-word translation. It seeks to give more than one meaning of a word in TT. To the extent that the computer succeeds in knowing which one of the meanings to choose, the translation will reach its translation goal. The biggest trick of the mechanical translation is idioms. In this regard, the difficulties are much more in social and literature texts.

In this respect, mechanical translation will be more fruitful to the extent that it is able to do sentence-for-sentence translation which human translation has reached. While a mechanical translation of any sentence of a text is performed, it is a necessity to know all the information of the whole context.

Methods Used in Machine Translation

In all machine translations bilingual dictionaries and grammar rules in Data-Form are used as moduls. Yet each method differs from each other. We can part the approaches in machine translation in four groups: Direct MT, rule-based MT, Corpus-based MT and information-based MT. There are advantages and disadvantages in each approach group. The methods used in Machine Translation are given in Figure 2.

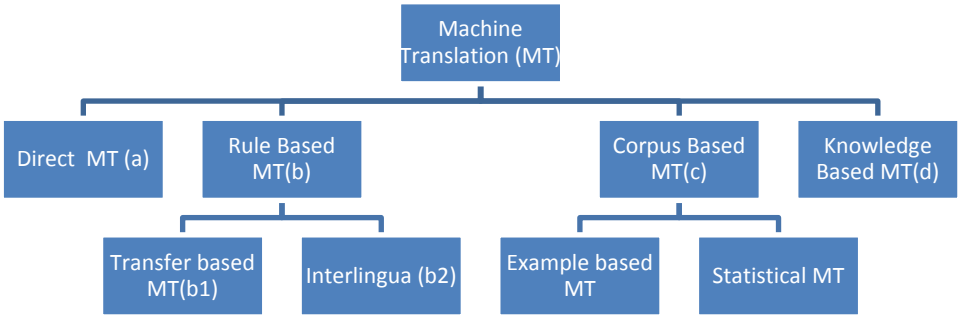

Figure 2.[2] Methods used in Machine Translation

(a) Direct Machine translation

There is no interim representation or a complicated structure in Direct Machine translation the block diagram of which is given in Figure 3. The words of the source text are transferred into TT with the same word-for-word arrangement with the help of bilingual dictionary. After the translation is performed, the sentences are changed according to the TL rules and then transferred into TL. This method is the oldest one. The stages of direct machine translation are as follows:

- The morphological inflections are removed from the words of the source text according to the different grammar rules of the word.
- The target language equivalent is found in a bilingual dictionary.
- Necessary syntactical arrangements are performed.

[2] This table was firstly used in the article of Jaganadh G. (2010) and was taken and modified according to the scope of this study.

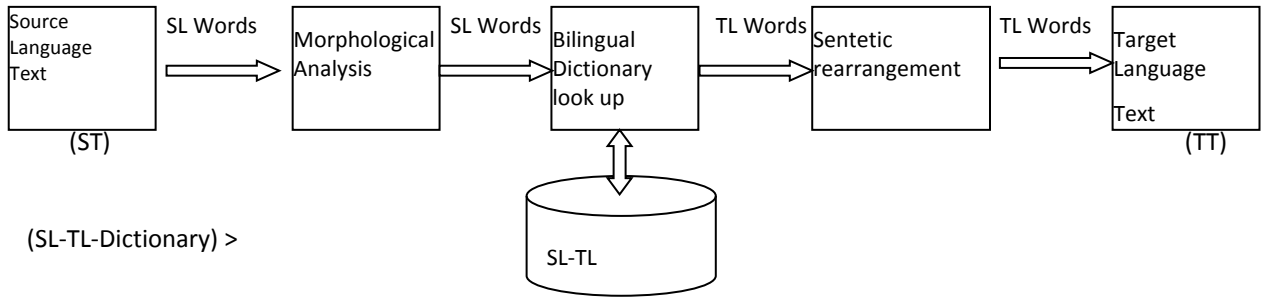

Figure 3.[3] Direct machine translation system **(Direct MT)**

The disadvantages of direct machine translation are that it does not take into consideration the structure and relations between the words, that a system developed for a given language cannot be applied to a different language and that the perceptions and changes in the language are not considered.

(b) Rule-based Machine Translation

Compared with direct Machine translation, rule-based machine translation yields better results . The system includes language rules which play an important role in machine translation and which are created by linguists. There are two rule-based machine translations: transfer-based and Interlingua.

(b1) Transfer- based MT : This application is a classic method comprising of three stages. These stages are Analysis, Transfer and Generation. First the grammar structure is analyzed. Then the semantic structure is produced. At the end, all actions are transferred into TT. Thus the operations performed in TT are reproduced. Transfer-based MT diagram is given in Figure 4.

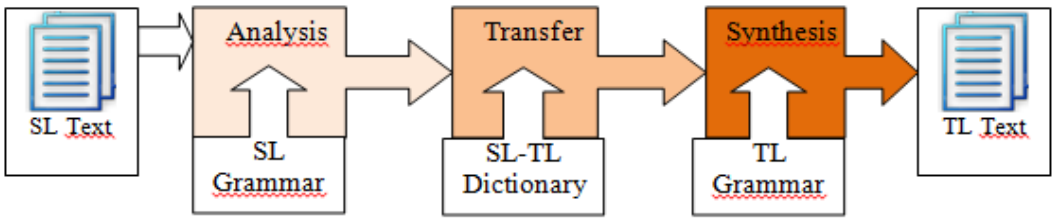

Figure 4.[4] Transfer-based MT diagram

(b2) Interlingua: Here the grammar data of the source text is analyzed and transferred into an second interlanguage (Zwischensprache). These grammar data is produced in TL via this second interlanguage. This method is suitable for the statements with multiple meanings.

(c) Corpus-based MT

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Corpus is the database of the conversations and words in a language. It is possible to see many studies on this subject. It results from the fact that there is a less need for qualified linguists. It is parted into two groups: SBMT (Statistics-Based Machine Translation) and EBMT (Example-Based Machine Translation).

(d)Information-Based MT

Information-based MT is a system that performs translation from a source language into a target language by using one of the morphological, syntactical or expanded semantic information. These kinds of systems make use of artificial intelligence.

Translation Programs

The number of MT systems and programs used today increases gradually. Especially recent years have seen great expansions and advances in this field. It is worthwhile to introduce some systems which are among translation programs.

a. SYSTRAN

SYSTRAN is one of the first commercially used machine translation systems. It was first used in 1971 for a translation from Russian into English. And NASA used SYSTRAN in sharing spacecraft information.

b. LOGOS

It was begun to be developed in 1964. It was used for translation from English into Vietnamese at Air Force of United States of America. It was supported by Siemens AG in 1978 and was used for the translation of communication documents from German into English. The system was not used any more since it was not found successful. Later, this system was bought by multi-partnered companies (Hewlett-Packard, Nixdof etc.).

c. COMSKEE

It is a system established and used by Saarbrücken Research Center (SFB-100). This system was specifically adapted to Computational Linguistics base. This is a program language oriented towards Linguistics. It has greatly contributed to MT. Translation processes are performed on mathematical four operations of addition, subtraction, division and multiplication (+ , - , : , x), logarithm and potential calculations and for this, "**Computers**" are an inevitable equipment. Elementary actions of mathematical logic (and - ^ , or > , negation >, if ---) are performed in the production stages of translation processes. For this reason, computer is necessary and without it there cannot be MT (K-D-Schmitz:1987:116).

d. EUROTRA (European Translation System)

EUROTRA translation system has been created with a work performed in 1982 at the request of European Union Council.

As is evident from its name, as EUROTRA was founded with the support and wish of European Union, it will conduct its operations with a function that will comprise of the states of European Union. We see that Turkey has not been included in the MT projects carried out up to now. Although included in the programs of some private firms, qualified Turkish translation programs have not yet been developed as we will see in the following text illustrations.

It could be overcome with the entry of Turkey into European Union. One reason why the executers of the MT programs up to now were not interested in Turkish is that Turkish has a rather different structure than the European languages that are accepted as main languages. After our private attempts on this subject, we learnt that there had to be computer programming knowledge besides theoretical knowledge. We understood that in order to take part in such a project, there is a need for a double skill of both processing and using theoretical knowledge in computer environment. Apart from that, we have understood that there is an alternative to work together with the dominant computer programmers.

European Center for Scientific Knowledge Processing too was performing works in this field too, They had

yielded the first product of their first work in 1963. With the system they had developed, they were able to translate 60,000 Russian words into English in an hour. 1000 Russian words were translated for 7 Dollars. When looked at from a financial aspect, it was seen that it could compete with human translation. While EUROTRA was focusing its attention on knowledge and developments, the Russian scientific institution ISPRA was concentrating on translation.

As a result of this cooperation, 115 translations were performed and a translation capacity of 700,000 words were realized between 1965 and 1968 (Piatrowski:1984: 335). As soon as the translations were obtained from the machine, they were given to the **Editors** with the Russian original text.Even though the machine could not translate the comparisons and formulas in the original text, a successful action had then been realized on the text base. It was observed that those who gave translation brief were more or less satisfied with the performed translations.

300,000 words were transferred with these translations done with IBM Computer system. A dictionary had a capacity of around 150,000 words.

e. SUSY: Meanwhile, significant works were being performed with a project (**Saarbrücken Mechanical Translation System**) conducted by **H. D. Moos** in Saarbrücken, Germany. Its works serve as a source for world-wide developments even today. It contributed significantly to MT with translations of word-for-word and word groups.

Though the works of mechanical translation augmented rapidly, it was not possible to make fast progress due to the resulting problems. This in turn led the researchers to translate texts in certain fields. The purpose was to settle the foundations of translation system. As a result, some characteristic views emerged.

- Full automatic translation cannot be performed completely.
- Understandable, albeit flawed, translations in specific languages and fields are performed.
- Much better translation programs should be developed and translations should be done with the existing good programs.
- The correlation of the languages to be applied in mechanical translation should be determined.

In 1966, the scientific academy of Automatic Language Processing Advisory Committee in USA performed works. After its works, this committee had some decisions about mechanical translation.

In parallel with the worldwide attempts, Germany conducted some mechanical translation works as well. The SUSY project in Saarbrücken could be given as an example to these works. Important developments to machine translation were made with this project. With a project named **"Feasibility study on fully automatic high quality Translation**" at the University of Texas, USA, in 1970, it was aimed to meet the fully automatic translation need felt in the fields of Philosophy, Linguistics and Computer. Numerous scientists as well as linguists worked in the development of this project.

The first outputs of this work showed that only the translations of individual sentences were successful and were presented by Stachowitz. For him, these works had to be concentrated more in the fields of descriptive, theoretical and comparative linguistics. In this way, many issues such as the studies of linguistic models would be examined (Stachowitz: 1973: 9).

The main starting point of mechanical translation is the realization of word-for-word translation with the help of a dictionary. The equivalents of the words are automatically brought and there is more than one translation possibility for each word in question. The problem here is the fact that the syntaxes of different languages cannot be ordered clearly. We have seen in the examples above that the syntaxes of German, English and Turkish are different and that problems arise resulting from that.

The computer has not yet completely succeeded in transferring the equivalency of different syntaxes, because each language carries a different syntax system. A second problem is how to give which one of the different meanings of the words and where to give. The whole problem lies at the two points here. It is seen that humans should be a part of this process. It is a fact that even human help cannot render mechanical translation completely automatic.

Application processes of mechanical translation

Trojanskji (1946) who started the first study in the field of mechanical translation made it possible for the mechanical system to be understood with the tool he acquired. With this tool, the researchers applied the following processes (Bruderer:1982:24).

1st Process: This system transfers the code number of each word of the foreign language into TT with the relevant codes. The name of this application is "directory system". The coding in this system is performed as such: A=01 , B=02, C=03.....Z= 26

The code number of the German word "**und**" is (as the code number of each letter is different) is 211404 with u=21, n=14, d=04. The equivalent of the English word "and" would be coded as 011404 with a=01, n=14, d=04 (**and** : 211404 = 011404). This system is not practical because an alphabet of 26 letters on average would have a combination of fourteenth power of 1.4 x 10, which would not be practical at all.

2nd Process: An application performed with the adoption of a dictionary system: trying to the give the code words of SL with the equivalents of TL.

	SL (fr.)	TL (eng.)
E.g.:	beau: 0205011200	beautiful :020501232009062112 (beautiful)
	Chien:0308090514	dog : 041507 (dog)

(Schwanke:1991:26)

If we consider that this system was made with the punched card system of the day (1947) we could understand how difficult it is. Still, it is an application that has a place in mechanical translation as a successful endeavor. Both the present situation is much more beyond it, and it is successful and easy. At the same time, the data are applied and realized on a digital environment.

3rd Process: The first step in this field was taken by two entreprenuers named Booth and Richens. It is a system which ensures that the root and affixes of the word reflect in the translation. It was an advanced stage compared with the first step. With this method, not the word with its root but just its root was kept in the memory. When a word was looked up and not found, the longest word that is nearest to it comes to the screen. It was a significant stage then but as the computer technology was not sufficient enough it could not yield the desired success. A block diagram belonging to MT conducted in this process is given in figure 5.

Director of Physical Sciences of **Rockefeller Foundation**, **Warren Weaver,** made an offer to Language and Physical Sciences and made it possible for this kind of works to be performed. In this context, the works **Erwin Reitler** performed at the University of Washington are noteworthy. The innovation that the foundation brought to the works is the new style it offered to the **human-machine** connection.

Text producer	+	Machine tr.	+	Review	=	Translation

Figure 5. MT. Block diagram showing the third process

Here it was not considered that the text producer should have TL knowledge. His/her task is to remove the words with double meanings from the ST. The task of the editor (Nachredaktuer) was thought to be all about orderly putting down on paper the text given by the machine. As seen, these works did not give the expected result either.

4th Process: In 1952, a conference on mechanic translation was held in U.S.A. for the first time. The significance of the international conference is that it accelerated the subsequent works. The creation of Russian Machine Dictionary was realized after the works of this conference. After even all this intervening time MT still was not able to proceed practically. The year 1955, in this sense, is a turning point to remember. Conducted at the same year and published in 1956, "Machine Translation of Language" is an important work carried out by **Booth**.

After all these works, the structure of the mechanical word was getting more and more complicated because the separated root and suffixes could not be found distinctly. The word was found either in the form of "root + suffix" or just in the form of "root". Also the "**roots**" was not found on their own. The suffixes and the words had to be found with individual structure numbers (e.g: -er:12; -st:75; -haft:81…) structure number This could not be achieved because the TL rules was not introduced to the machine completely. The biggest hardship here was that the machine did not completely identify the syntax rules and idioms of SL and TL. Meanwhile, while there were intense works being performed on MT in America, in Russia there were intensive developments where 500 researchers took part.

The Realization of Natural Language Elements in Computer

The most important component of this process is database. The data on the database constitutes all the materials and building stones of machine translation. Databases should have such information:

a. Morphological explanations
b. Syntax explanations
c. Word roots
d. Word separations and suffixes
e. Frequency differences between the words (such as gehen: **go** on foot / fahren: **go** with a car Geist: life, soul)
f. Expression styles
g. Bibliography

While the information above and the explanations of roots and words are being loaded to the database, the characteristics of both partner languages should be known in detail. However, as will be seen in the following example, there may arise difficult problems to resolve such as the emergence of different translations in the German equivalents of an English expression.

Terminology Formation in Mechanical Translation

Unknown words seem to be more than normal in a text before a translational act gets started. For this reason, it is more useful to do a raw translation firstly, put the new words instead of those which cannot be determined by the computer and start the translation in that way. Terminology relating to the expertise fields of relevant texts could be loaded to the database or could be added in addition to the existing dictionaries. Trados translation program could be given as an example to it. The function of Trados translation programs continually increases.

Trados was founded as a language service provider (LSP) in Germany in 1984. The company started developing translation software at the end of 1980's. By the end of 1990's, it had become an important trademark in desktop translation memory software. Trados was purchased by SDL in 2005 (www.trados.SDL :14.10.2012). In SDL/Trados system, MultiTerm Extract process operates and the following concepts are valid. They are operated on action process.

Monolingual Term Extraction Project	MultiTerm Extract extracts source language terms starting with a, b, c, and d, up to a maximum of 100 terms. If the source language is not Latin alphabet-based, the first 100 terms are extracted. No export functionality is available and projects cannot be saved.
Bilingual Term Extraction Project	MultiTerm Extract extracts source language terms starting with a, b, c, and d (and associated translation proposals), up to a maximum of 100 terms. If the source language is not Latin alphabet-based, the first 100 terms are extracted. No export functionality is available and projects cannot be saved.
Translation Project	MultiTerm Extract processes the first 20 terms that are common to both the termbase and the bilingual input files. No export functionality is available and projects cannot be saved.
QA Project	MultiTerm Extract processes QA projects that contain one file only; the file must be less than 100KB in size. No export functionality is available and projects cannot be saved.
Dictionary Compilation Project	MultiTerm Extract extracts source language terms starting with a, b, c, and d (and associated translation proposals), up to a maximum of 100 words. If the source language is not Latin alphabet-based, the first 100 words are extracted. No export functionality is available and projects cannot be saved.

(www.SDL Multiterm 2007)

There is a dictionary server in MT translation. Some firms create their own databases and create translation programs. If the technical side of the issue, the money and time spent and the difficulty thereof are considered altogether, it is more appropriate for the firms to buy ready translation programs from the outside. However, the firms Siemens, Bosch and Mercedes which develop their own translation programs make significant progresses on it. After overcoming the specified hardships, the introduction of original translation programs creates more productive, faster and more qualified translation from the programs that could be bought.

Many terminologies are created automatically im MT where works have been conducted since 1950's. These words are put on our agenda as specialty language **(Fachsprache)**. These newly coined words are called (information) source.

The act of machine translation is a phenomenon where appropriate algorithm operations are realized on Computer with the power of human intelligence. In other words, Mechanical translation is the realization of appropriate algorithm marks on machine environment with human power.

Here what is mentioned is a phenomenon that does not take place in human practice. Each number, figure and mark processed by computers, and each command given to the computer are stored in a cell within its memory. The operation occurring here or realized by humans is "**Euclidean Algorithm**".

Ders bitene kadar beklemelisin. – Du musst warten, bis der Unterricht aus ist. (German)

The above sentence is comprised of a series of words. We should express the forms of discourse and meaning created by each word and their suffixes with direct speech paraphrase) What constitutes the content of the text is paraphrase. Each word, suffix, letter and grammatical mark that serves a purpose in the sentence has a value. If we give the number equivalents of each element in order to find the value of this sentence, we will be confronted with millions of numbers. In this regard, it is revealed that the euclidean algorithm is an inevitable mathematical operation (Ljudskanow:1972:219).

Accordingly, Machine Translation should have the following characteristics:

a. The translation should reflect the word meanings of the original text

b. It should reflect the inner meaning of ST.

c. The TT should be read as the original

d. The TT should reflect the style of the translator

e. TT should reflect the style of ST author by adapting to the style of the translator

f. TT should also reflect the time when the ST was created

g. Nothing should be added to or removed from the TT

h. If the translation cannot be transferred as poetry, it should be transferred as prose

As we have stated before, although all the translation programs use different methods, they are basically established on computer technology. With each passing day, new usage conveniences and solutions for MT are created along with the innovations in computer technology.

Technology Use in Translation Works in European Union

For multilingualism, language learning has crucial importance for European Union. Multilingualism has been accepted as a identity determination criterion for EU. In this regard, European Commission has Directorate-General for Translation. Translation briefs are performed among 23 languages in 27 member countries. Directorate-General for Translation of European Union Commission conducts these translation briefs.

The translators in the Directorate-General for Translation work with translator's work bench and translation memories. This commercial application package (TWB) is a program that includes local translation memory and stores all official documents and allows for being taken from itself when necessary. In addition to them, **Euromis** (European Advanced Multilingual Information System) is a commonly used application. Euromis is a set of web applications that is combined with electronic mail mechanism and that allows access to many services in the field of language operations. Terminology formation in the Directorate-General for Translation is the task of language departments. By means of terminologists, these departments support the formation of the terminology necessity for the translations between the official languages of EU. The Union supports for the formation of different institutions for the development of the following translation professions: European machine translation (computer translation) institution, European Council of Associations of Literary Translators, European Community of Translation Works and European Union of Associations of Translation Companies (www.euro.eu.) http://ec.europa.eu/pubic

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subtraction, division and multiplication (+ , - , : , x), logarithm and potential calculations and "**Computer**". Elementary actions of mathematical logic (und - ^ , oder > , negation >, wenn ---) are performed at the formation stages of translation processes. In this regard, computer is necessary and without it, MT cannot be realized (K-D-Schmitz:1987:116).

The system processes raw translation (Rohübersetzungen) in fully automatic translation process. Specific subject domain texts are more suitable for the structure of the system. These texts are processed in a short time, that is, translated and put into the service of the customers. LFC system has a capacity of processing one word in a second or 200 pages of text in a work day (Schwanke:1991:104).

CONCLUSION

As the countries become closer and closer to each other, people are left no choice but to reach more information. This in turn created an effective translation need between languages. Automatic machine translation is a commercial market and a new research area which ensures that people instantly access current information in global world. While mechanical translation is a field also related to artificial translation, it is the research subject of also linguistics, informatics and computer science. Today, MT is a world-famous branch of Software Industry and many softwares have been developed in this field. Most of them are carried out in University environments. Despite these, 1 % of all the translations is performed with MT (www.google.de/maschinelle übersetzung). In this study, machine translation, methods used in machine translation, the past and present of machine translation have been presented. In the light of these explanations, still many works are being conducted on machine translation. In spite of this, it cannot be denied that human translation is inevitable and irreplaceable in this process.

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