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ACCURACY OF WORD ORDER IN PHRASES AND SENTENCES RESULTING FROM MACHINE TRANSLATION

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ABSTRACT
This research discusses the accuracy of word order in phrases and sentences produced by machine translation. Machine translators, using natural language coding technology, have demonstrated rapid progress in translating text between languages. However, problems still occur, especially in the context of complex sentences and language nuances. This study analyzed various research related to this matter using the Systematic Literature review (SLR) method. In this research, a review and identification of all articles published in the 2013-2023 period were carried out. After a thorough search was carried out, 25 articles were obtained that met the criteria. This article illustrates that machine translation tends to perform best on simple sentences, while accuracy can vary in more complex situations. Manual revision by humans remains necessary to ensure accuracy and consistency in wording, highlighting the importance of understanding context and linguistic nuances in the development of more sophisticated machine translations.
Keywords: Accuracy, Word Order, Machine Translation

INTRODUCTION
Automatic translation machines were created with the aim of simplifying translation activities, including translation. Machine translation is a computer software or device tasked with translating text from one language to another (Localization Industry Standards Association [LISA], 2010). Translation is the process of reproducing a message from the source language to the target language (Nida, 1969). Despite offering convenience and practicality, the quality of machine translation is still questionable. Translation would be easy if each word in the source language had only one possible translation in the target language (and vice versa) and the order or arrangement of words/phrases in the source language and target text. In this case, translation would be reduced to replacing the source word with the target word—words that can be looked up in a dictionary. If translation were that easy, Machine Translation (MT) would work perfectly, eliminating the need for human translators and even post-editing of machine translation. However, the word order or phrases produced by machine translation still often contain errors. Words will form phrases, phrases will form clauses, clauses will form sentences. Therefore, word order greatly affects the results of a translation. In addition to the algorithms relied on by Machine Translation in translating, perfect word order/phrases must still be done by humans. Nababan (2003) The quality of the translation itself can be assessed based on aspects of accuracy, acceptability, and readability. Based on the experience of researchers when using MT for translation, the translation results seem less natural and confusing. There are many inappropriate word pairings and word order still follows the grammatical structure of the source language. Word order/phrase is very important in getting good translation results.

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There are several previous studies related to this. First, Killman's (2014) study entitled "Vocabulary Accuracy of Statistical Machine Translation in the Legal Context." The study examined the accuracy of the free online SMT output provided by Google Translate (GT) in the context of challenging legal translation. This paper analyzed the English machine translations produced by GT for a large sample of Spanish legal vocabulary derived from a large number of summary texts of decisions made by the Spanish Supreme Court. The study argued that MT in the context of legal translation should be useful if its output can consistently provide a number of reasonably accurate translations of the types of vocabulary that translators in this context often have to research before being able to translate them effectively. Next, the study conducted by Anari and Bouali (2019), entitled "Naturalness and Accuracy in English Translation of Hāfiz." The aim of this study was to examine the level of naturalness and accuracy of Hāfiz's English translations by native English and Persian speakers. This research approach is a comparative approach and therefore a descriptive methodology is applied in this study. After surveying both translations, the researchers came to the conclusion that in the sample studied the translation of Hāfiz's ghazal by the Iranian translator was more accurate, while the translation of the English translator was more natural. Further research comes from Amerhein et al. (2022) entitled ACES: Translation Accuracy Challenge Sets for Evaluating Machine Translation Metrics. This study uses a metric method. Where researchers curated ACES1, a Translation Accuracy Challenge Set, consisting of 68 phenomena ranging from simple disturbances at the word/character level to more complex levels based on real-world discourse and knowledge. Next, Sipayung (2019) entitled The Impact of Translation Shift and Method on Translation Accuracy Found at Bilingual History Textbook. The purpose of this study aims to determine the dominant translation shift, the dominant method and impact of the shift and method on the aspect of translation accuracy. Researchers used a qualitative descriptive method to determine the research objectives. There are two types of data in this study: affective and objective.

Then, Patil and Davies (2014) wrote Use of Google Translate in Medical Communication: Evaluation of Accuracy. The purpose of this study was to evaluate the accuracy and usability of Google Translate in translating general medical statements into English. Furthermore, Aresta and Nababan (2018) wrote The Influence of Translation Techniques on the Accuracy and Acceptability of Translated Utterances that Flout the Maxim of Quality. This study aimed to examine how implicit meanings are translated. One example is translating utterances that violate the maxim of quality. This study investigated how translation techniques can affect translation quality. The approach applied in this study is pragmatics in translation. This study used a qualitative descriptive method. This was followed by a study conducted by Toma et al. (2014) on the Elements of an Accurate Tree-to-String Machine Translation System. This study describes the process of developing an accurate and culturally relevant translation of the Connor–Davidson Resilience Scale (CD-RISC) from English to Arabic. Resilience is an important health construct that can be applied to research on mental illness and adaptive capacity. For example, increased resilience appears to protect against declines in mental health.

From previous studies, many studies have focused on developing algorithms and metrics to improve the accuracy of machine translation. In addition, other studies use manual text data to assess translation accuracy, not machine translation results. Then, the methods used are examined. Most studies use metrics and content analysis methods. In this study, researchers want to examine the accuracy of word order in phrases and

sentences translated by machine translation using the SLR method. Researchers want to identify and describe how accurate word order is in machine translation. This study raises research questions: 1) How accurate is the word order in phrases and sentences translated by machine translation? 2) What are the limitations of machine translation in translating pragmatic meaning? 3) What are the significant differences in machine translation accuracy compared to humans? 4) To what extent can machine translation accuracy be improved? 5) How can translation quality be evaluated by machine translation?

Therefore, research related to the accuracy of word order in machine-translated phrases and sentences is important. This study will analyze various related studies using the Systematic Literature Review (SLR) method. Systematic reviews are useful for producing quality research. SLR is a research method that systematically reviews specific problems that have been identified, assessed, and concluded according to predetermined criteria based on evidence from quality and relevant research. In this study, we reviewed and identified all articles related to the accuracy of word order in machine-translated phrases and sentences published between 2013 and 2023. Articles were obtained from the Google Scholar database using the Publish or Perish applications.

In this study, the researcher used several theoretical studies. Translation is the process of transferring messages from the source language (SL) to the target language (TL) so that they can be understood by the TL audience while still preserving the original meaning (Newmark, 1988; Nida, 1969). In practice, various translation techniques are used (Molina & Albir, 2002), such as adaptation, borrowing, calque, compensation, description, discursive creation, established equivalence, generalization, modulation, reduction, transposition, and others, totaling 18 techniques. In addition to techniques, translation methods according to Newmark (1988) are divided into eight: four oriented toward the SL (word-for-word, literal, faithful, and semantic translation) and four oriented toward the TL (adaptation, free, idiomatic, and communicative translation). Assessing translation quality is also important, as stated by Machali (2009), to bridge theory and practice and to establish standards for translator competence. Nababan (2010) proposed three assessment parameters: accuracy (equivalence of meaning and style), acceptability (naturalness and appropriateness in the TL), and readability (ease of understanding by readers), each evaluated using a 1–3 scale to measure how well the translation meets these quality criteria.

METHOD

This study used a Systematic Literature Review (SLR) approach. Twenty-five articles met the criteria. The Search Process was used to obtain or search for relevant sources to answer the Research Question (RQ), and other related references using a search engine (Google Chrome) with the site address https://scholar.google.com. In this study, the researcher also used Publish or Perish (PoP) in searching for relevant sources. In conducting SLR, strategies and methods are needed in searching for related research. The first stage is searching for related research based on search keywords. The keywords for searching for literature in this study are "Machine Translation Accuracy", "Machine Translation", "Translation", "Translation", "Word Order" and "Translation Accuracy". These keywords are then entered into the search feature available on Google Scholar. The database is searched based on title, keywords, and abstract. The second stage is Review 1 which identifies and analyzes through literature output. At this stage, research papers obtained from the paper search will be selected. Paper selection includes: (1) Eliminating literature with titles that do not match the specified keywords. (2) Eliminating literature

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that is not from conferences or journals. (3) Eliminating duplicate papers. (4) Eliminating literature that does not match the specified year range.

The results of Review 1 will be carried over to Review 2, which will analyze the paper internally. In the Review 2 stage, an analysis is carried out from the abstract side. The remaining literature will be selected by: (1) Eliminating literature with abstracts that are not related to the predetermined keywords. (2) Eliminating papers with unusual content or paper formats. The remaining results in Review 2 will be grouped based on the information system development method used. Then in the final stage, the researcher conducts a selection. The selection carried out is a selection by assessing the quality of the paper based on the Quality Assessment (QA) list. Quality Assessment or QA is formed based on a list of problem formulations. QA must contain assessments to answer all problem formulations. In this study, the data found will be evaluated based on the following quality assessment criteria questions:

Table 1. Quality Assessment Berdasarkan Research Question

No.	Research Question	Motivation
1.	How accurate is the word order in machine-translated phrases and sentences? Identify the accuracy of word order in machine-translated phrases and sentences.	Identify the accuracy of word order in machine-translated phrases and sentences.
2.	How significant are the differences in machine translation accuracy compared to human translation? Identify the significant differences in machine translation accuracy compared to human translation.	Identify significant differences in machine translation accuracy compared to human translation.
3.	To what extent can machine translation accuracy be improved? Identify the extent to which machine translation accuracy can be improved.	Identify the extent to which machine translation accuracy can be improved.
4.	How can machine translation quality be evaluated? Identify the evaluation of machine translation quality.	Identify translation quality evaluations for machine translation.

For each literature review, the following scores will be assigned to each of the questions above. Y (Yes): for literature that meets the quality assessment questions. T (No): for literature that does not meet the quality assessment questions. Data extraction is also required in this study. After the selected data have been extracted, they are then collected to contribute to answering the research questions. A data extraction form was designed to collect data from the primary studies needed to answer the research questions. Properties were identified through the research questions and the analysis conducted by the researcher. Three properties were used to answer the research questions, as shown in Table 2. Data extraction was conducted iteratively.

Table 2: Data Extraction Properties Mapped to Research Questions

No.	Properties	Research Questions
1.	Accuracy of word order in machine-translated phrases and sentences.	Q1, Q2, Q3
2.	Evaluation of translation quality by machine translation.	Q4

RESULTS AND DISCUSSION

In this Systematic Literature Review (SLR), 25 journals analyzed the accuracy of word order in machine-translated phrases and sentences. Information on this was obtained based on the formulated RQs. The findings from each RQ are described below. RQ1: What is the accuracy of machine-translated word order? Based on the literature review, seven articles were identified. The details are shown in Table 1:

Table 1. Accuracy of Machine-Translated Word Order

No.	Author and Year	Journal Name	Results
1.	Milan Aiken (2013)	Communication of IIMA	In this study, two objective raters evaluated common phrases translated from German and Spanish into English using four online translation services. Google Translate was the most accurate. Even in cases where grammar was unclear, the meaning could often be ascertained. Based on these results, we believe Google Translate is the most accurate online service for translating German and Spanish texts into English.
2.	Jeffrey Killman (2014)	Journal of Modern Linguistics	The results of this study indicate that Google Translate is indeed capable of accurately translating vocabulary extracted from a large number of legal texts intended for expert readers in over 64% of cases. This suggests that it is a reliable tool for legal translators who might find it useful.
3.	Sumant Patil (2014)	BMJ Journal	This study found that Google Translate is a free, readily available online machine translation tool for 80 languages worldwide. However, the study found limitations in medical phrases used in patient-doctor communication. Many translations were completely incorrect.
4.	Wisnu Setya Budi (2021)	Klausa Jurnal Linguistik, Pembelajaran Bahasa dan Sastra	The results of this study concluded that, in terms of accuracy, economic news, political news, and health news were categorized as less accurate. Most of the translation inaccuracies in these three news items were caused by inappropriate wording and word matching.
5.	Noezafri Amar (2013)	Madah Jurnal Ilmiah Bahasa dan Sastra	This study concluded several things. First, only about 31% of the 13 source data were considered accurate translations, while the majority (54%) were considered less accurate, and another 15% were considered inaccurate. The reliability of GT in producing accurate translations was only 31%. Thus, the conclusion suggests that GT has limitations when dealing with more complex matching strategies.
6.	Tabinda Putri Citra (2021)	Jurnal Nasional Bahasa Arab	The results of this study indicate that MT has many limitations, resulting in translations that are less than appropriate and accurate according to linguistic principles, including morphological, semantic, and syntactic aspects. MT is unable to analyze the grammar and context of a reading sentence from the source language (Arabic) to the target language (Indonesian).
7.	Abdullah Achmad (2016)	Indonesian Journal of Applied Linguistics Review	This study found that the quality of translations of scientific texts in the educational field produced by Google Translate can be described as inaccurate, moderately readable, and unacceptable. Meanwhile, the quality of translations of scientific texts in the educational field produced by Bing Translator can be described as inaccurate, moderately readable, and unacceptable. A comparison of the translation quality of scientific texts produced by Google Translate and Bing Translator machine translations shows that the translation quality of Google Translate is superior to that of Bing Translator.

Based on the findings above, it can be concluded that the accuracy of machine translation results can vary depending on the complexity of the language, context, and type of document being translated. Machine translation, especially those based on artificial intelligence like GPT-3.5, has achieved a fairly good level of capability in translating text from one language to another. However, translation accuracy can still be affected by

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several factors. For example, machine translators may have difficulty capturing cultural nuances, figurative meanings, or complex sentences that require a deep understanding of context. Furthermore, machine translation may not yet be fully capable of addressing variations and differences in language structure across cultures. It is important to note that although machine translation has made significant progress, there are limitations and situations where human translation results are still superior. Therefore, in critical situations or when high accuracy is required, human translation is still considered more reliable.

The next result of RQ2 is to determine the significant differences in machine translation accuracy compared to human translation. Based on the literature review, six articles were found. The details are shown in Table 2:

Table 2: Significant Differences in Machine Translation Accuracy Compared to Human Translation

No.	Author and Year	Journal Name	Results
1.	Sumant Patil (2014)	BMJ Journal	The analysis found that Google Translate only achieved an accuracy rate of 57.7% in translating medical phrases, making it unreliable for crucial medical communication. Nevertheless, Google Translate remains a readily accessible and free initial communication option between doctors and patients when language is a barrier. While caution should be exercised in life-saving situations or critical legal communications, human translation services can be a useful supplement when Google Translate is unavailable.
2.	Tabinda Putri Citra (2021)	Jurnal Nasional Bahasa Arab	This study found that using machine translation provides users with the convenience of instantly and economically translating text. However, this Google-provided service has many limitations, resulting in less accurate and linguistically accurate translations, including those related to morphology, semantics, and syntax. Google Translate is unable to analyze the grammar and context of a sentence from the source language (Arabic) to the target language (Indonesian). Therefore, the accuracy of human translation is higher than that of machine translation. Human assistance/post-editing is still necessary to improve translation results.
3.	Novia Arifatun (2013)	Journal of Arabic Learning and Teaching	The results of this study indicate that translating Indonesian text into Arabic using MT services will be accurate if the source language is translated word-for-word into the target language. However, it does not provide accurate translations if the text is translated sentence-by-sentence. The analysis revealed a number of errors that dominated the results. Compared to human translation, the results were more accurate.
4.	Wahyu Untara (2020)	Adabiyyat: Jurnal Bahasa dan Sastra	This study concluded that despite various translation issues, Google Translate's translation results show several promising benefits. However, an experienced translator can easily identify inconsistencies and correct them with appropriate translation techniques. Based on research conducted on English-Indonesian book translations, it can be concluded that Google Translate can work well as an aid in the initial translation process. This service helps translators understand the overall content of the source text and allows translators to work based on this initial process. However, the translator's skills are crucial in translation.

Although machine translation has made rapid progress and can produce quite good results in some situations, there are still significant differences in accuracy between machine and

human translation. While machine translation has become a very useful tool and continues to evolve, human translation is still considered more reliable in many contexts, especially when dealing with complex, nuanced texts, or those requiring creative interpretation. Machine translation is more suitable as a backup tool or a quick option in situations where time and resources are limited.

RQ3 then addresses the extent to which improvements in machine translation accuracy can be achieved.

Based on the literature review, six articles were found. The details are shown in Table 3.

Table 3: The extent to which improvements in machine translation accuracy can be achieved

No.	Author and Year	Journal Name	Results
1.	Danny Indrayana (2016)	Justin: Jurnal Sistem dan Teknologi Informasi	This research uses the PoS feature in a statistical machine translation tool from Indonesian to Pontianak Malay to improve translation accuracy. Testing was conducted by comparing the accuracy of translation results before and after PoS implementation. The study used a parallel corpus of 3,050. Testing was conducted using two methods: automated testing using Bilingual Evaluation Understudy (BLEU) and testing by Pontianak Malay language experts. The results show that the use of PoS can improve translation quality for machine translation tools from Indonesian to Pontianak Malay.
2.	Bharathi Raja Chakravarthi (2021)	SN Computer Science	This paper presents an overview of the current state of machine translation that utilizes orthographic information, including rule-based machine translation, statistical machine translation, neural machine translation, and unsupervised machine translation.
3.	Yangruibo Ding (2021)	Journal Automated Software Engineering	As part of this review, we introduce different machine translation methods and demonstrate how orthography plays a role in the accuracy of machine translation results. These methods for utilizing orthographic information have significantly improved machine translation accuracy.
4.	Bella Anggrina (2017)	Journal English Language and Teaching	This research shows that machine translation (MT) has several limitations, resulting in inaccurate translation results and a high number of errors. To achieve high-quality output, EFL learners use post-editing to revise the translation output generated by the machine translation (MT) system. In post-editing, learners modify lexical and syntactic categories by replacing and adding words. Meanwhile, in full post-editing techniques, learners not only modify lexical and syntactic categories but also use appropriate style, fluency, and maintain complete fidelity to the source text.
5.	Aarthi Reddy (2015)	ACL Anthology	This research describes methods for integrating source and target language information for human-assisted machine translation. These methods are applied to a language translation task involving human translators dictating a draft translation of a source-language document in advance.
6.	Lucia Specia (2017)	ACL Anthology	This research introduces a large and unique dataset derived from industry data that has been post-edited and annotated by professional translators. This dataset measures post-editing productivity and can be used to detect error patterns in MT output. And can increase the accuracy of Machine Translation

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Machine translation accuracy continues to improve alongside technological advances and research in artificial intelligence. While it's impossible to provide a definitive estimate of the extent of future improvements, some factors that could influence accuracy improvements include: 1) Language Model Development, 2) Improved Training Data, 3) Integration of Contextual Knowledge, 4) Allusion Recognition and Handling, 5) Human Feedback and Continuous Learning, and 6) Development of Contextual and Semantic Techniques. While there is significant potential for improvement, it's important to remember that machine translation may never fully replace human translation in highly complex contexts or those requiring highly refined interpretation. Machine translation will continue to evolve as an effective tool, but the human ability to understand social, cultural, and nuanced contexts remains invaluable.

The results of RQ4, which focused on evaluating machine translation quality, are detailed in Table 4.

Table 4: Evaluation of Machine Translation Quality

No.	Author and Year	Journal Name	Results
1.	Franck Burlot (2017)	ALT Anthology	This study presents a new protocol for evaluating the morphological competence of machine translation systems, with the aim of measuring progress in handling complex morphological phenomena in source and target languages. Initial experiments for two language pairs demonstrate that NMT systems with BPE outperform phrase-based MT systems in many respects.
2.	Alina Cesar (2013)	Computer Science Linguistics	This study examines various frameworks used in translation evaluation processes, with a particular focus on error classification schemes used both in the translation industry and in institutional translation teaching. Error-based models such as BlackJack or SAE J 2450 allow human evaluators to benefit from consistent and systematic errors.
3.	Markus Dreyer (2013)	ALT Anthology	These findings demonstrate that naturally occurring sentences have billions of translations. Having access to such a large set of meaningfully equivalent translations allows us to develop a new metric, HyTER, for translation accuracy. This study demonstrates that this metric provides better estimates of machine and human translation accuracy than alternative evaluation metrics.
4.	Lynne Bowker (2023)	Meta Jour. des traducteurs Translators' Journal	This study presents a specially designed Evaluation Corpus that can act as a benchmark against which translator trainers can compare student translations.
5.	Nitika Mathur (2020)	Cornell University	Overall, these findings suggest improvements to evaluation metrics protocols and system performance evaluation in machine translation.
6.	Joseph P. Turian (2013)	ALT Anthology	This study demonstrates that machine translation can be evaluated using measures such as precision, recall, and the well-known F-measure. The unigram-based F-measure correlates significantly higher with human judgment than recently proposed alternatives. Importantly, this standard measure has an intuitive graphical interpretation, which can facilitate insights into how MT systems might be improved.

Evaluating machine translation quality is a crucial step in determining the extent to which a machine translation tool meets specific needs and standards. Many evaluation methods are commonly used. Each evaluation method has its own advantages and disadvantages, and a combination of several methods is often used to provide a more complete picture of machine translation quality. Continuous evaluation is necessary because machine translation tools are constantly being updated and improved, and regular evaluations help identify areas for improvement.

CONCLUSION

Although machine translation uses natural language processing technology to translate text, its success still depends on the complexity and context of the translated sentence. Rapid advances in machine translation development have improved its capabilities, particularly in translating simple sentences and straightforward phrases. However, in the case of complex sentences or sentences containing linguistic nuances, machine translation can still encounter challenges. The translation may not always reflect the full meaning, and the accuracy of wording can vary. Therefore, it is important for users to remain vigilant and manually revise the translation, especially when context and nuance are important to the communication.

In conclusion, successfully maintaining proper wording helps maintain the readability and clarity of the translation. Machine translation is a useful tool for quickly translating text, especially for simple sentences. However, for more complex texts, understanding context and capturing linguistic nuances remains a challenge, and human involvement is still required to ensure accurate and faithful translations. Further developments in natural language processing technology are needed for machine translation to overcome these obstacles and deliver more precise results in a variety of contexts. Therefore, continued efforts to develop machine translation's ability to understand and reproduce accurate wording are key to improving overall translation quality.

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