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Application of House's Translation Quality Assessment to Persian Translation of Technical Texts

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Abstract

In this research, the quality of the Persian translation of a computer textbook was assessed based on House's model of Translation Quality Assessment (TQA). To achieve reliable results, the two aspects of repeatability and reproducibility were considered. To ensure repeatability, researchers assessed the translation quality of randomly selected excerpts. After two weeks, excerpts were reassessed to ensure no differences were in the frequencies and kinds of detecting mismatches. Regarding reproducibility, four raters were asked to assess the translation quality of excerpts to ensure no differences were noted between the reported results by the researchers and raters. Moreover, the inter-rater reliability of the researchers and raters was measured. The chi-square test was used to measure the differences between expected and observed errors as well. Both theoretical and statistical analyses emphasize that the quality of the Persian translation is low; furthermore, it was translated overtly rather than covertly.

Keywords: Chi-Square Test, Inter-rater Reliability, Overt Translation, Translation Quality Assessment

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Introduction

Computer textbooks are the primary sources for master's and Ph.D. students in computer science. From one side, most students cannot use them due to the lack of language knowledge. Consequently, they need to use translated versions. From the other side, most translated versions have low quality and therefore, the students cannot use them properly (Hosseinimanesh & Dastjerdi, 2013).

Translation Quality Assessment (TQA) is an activity that, despite being widespread, is under-researched (Hatim & Mason, 2005). More significantly, assessing the translation quality of computer texts has not been studied enough. Moreover, it is rare to find authenticated information about the special features or the best translation practices for Computer textbooks (Nokkonen-Pirttilampi, 2007). Although there is some research on user manuals of computer products, such research is only partly applicable to computer textbooks, because their purpose and structure differ from computer textbooks to some extent.

The book "Protocols and Architectures for Wireless Sensor Networks" (Karl & Willig, 2007) has been known as a comprehensive source for computer networks (Bilstrup, 2008). It provides researchers, graduate students in computer engineering, telecommunication engineering, and electrical engineering, as well as practitioners in industry and research engineers with an understanding of the specific design challenges and different solutions for wireless sensor networks (Napack et al., 2023).

Up to the date of writing this research, the only Persian-translated version of this book has been translated by Mohsen Jahanshahi in 2016. In this research, the book and its Persian-translated were taken respectively as Source Text (ST) and Translated Text (TT). At the time of conducting this research, no attempt has been made to assess the quality of the TT. To compensate for this gap, in this research, the quality of the TT was assessed by applying the House's TQA model (House, 2014).

House introduced overt and covert translations for translating non-technical and technical texts, respectively. Moreover, she classified errors into overt and covert errors. Accordingly, denotative mismatches, as well as breaches of Target Language (TL) norms, are classified as 'overt' errors. Furthermore, mismatches of dimensions are considered 'covert' errors (House, 2014). Based on House's model, the attempt of this research was to answer the following questions:

- How was the TT translated, overtly or covertly?
- Which kinds of covert errors were made in the TT?
- Which kinds of overt errors were made in the TT?

Literature Review

Translator's Competence

Like other types of translations, mastery of the Source Language (SL) and the ability to embody the authors' intention is needed to translate computer texts (Hosseinimanesh & Dastjerdi, 2013). For instance, the term "up to" on Page 38 of the ST, is equal to the term "حداکثر تا". However, due to the lack of mastery in SL, it was wrongly translated into the term "بیش از".

In addition to the mastery of the SL, translating computer texts needs an advanced level of knowledge in the subject as well as mastery of the relevant specific terminologies (Hosseinimanesh & Dastjerdi, 2013). For instance, the specialized term "gross data rate" on Page 22 of the ST, was wrongly translated into the "نرخ انتقال داده خالص". However, according to the book entitled "Digital

Transmission: A Simulation-Aided Introduction with VisSim/Comm" (Guimaraes, 2010), this specialized term has been defined as "the total numbers of transferred bits per second over a link, including both user and control data". Consequently, the Persian equivalent of "gross data rate" is "نرخ انتقال داده ناخالص".

Furthermore, translating computer texts needs an advanced level of mastery in the TL (Hosseinimanesh & Dastjerdi, 2013). For instance, in the translation of the noun phrase "transformed algorithms" on Page 50 of the ST, the translator translated it to the phrase "الگوریتم‌های تغییر شکل داده شده" which does not prevalent in Persian academic formal writing. In contrast, using "الگوریتم‌های تغییریافته" is more common and suggested.

Because of the aforesaid requirements, translating computer texts is a hard task. Since there is no room for mistranslations in the translation of computer texts, assessing the translation quality of such texts is necessary. The quality of the translations can be assessed through TQA models.

TQA Approaches

TQA models are categorized into two kinds of qualitative and quantitative models (Abdulmoghni & Al-Sowaidi, 2024). Qualitative models itself are subcategorized into three types: anecdotal and subjective, response-oriented, and text-based approaches (House, 2014). Since the primary objective of this research was not to propose a new model for TQA, the selected model should provide explicit guidelines for TQA. The anecdotal, subjective, and response-oriented approaches do not propose any explicit criteria. Moreover, response-oriented approaches focus on TT and ignore ST. Furthermore, the main disadvantage of text-based approaches is that they do not clearly describe how the TQA should be applied in practice. However, among the text-based approaches, there are several models which present the way the model should be applied. Such models have been developed by Gerzymisch-Arbogast (1994) and House (2014).

Gerzymisch-Arbogast's TQA model (1994) is too strongly "bottom-up", with too little "top-down" provided for systematization and generalization. In addition, although its assumption of equivalence on the level of culture is accepted in translation studies, this assumption is highly dubious. Moreover, its notions such as "Kulturem" developed in a different framework cannot simply be transferred to translation and its concern for equivalence relations (House, 1997). This issue can lead to insurmountable problems for the researchers. House's model proposes explicit criteria and the way the model should be applied in practice. Moreover, this model considers both ST and TT and does not analyze the TT in isolation. Consequently, in this research, House's model was selected to assess the quality of the TT.

Related Studies Review

Technical translation refers to the translation of non-literary literature, such as scientific and technical texts, business contracts, instructions, and so on. Although much research has been performed in TQA of non-technical literature, technical literature, especially Computer textbooks has been almost ignored (Nokkonen-Pirttilampi, 2007). It is necessary to mention that several studies were carried out to assess the translation quality of computer products' user manuals by Kustanti and Agoes (2017), Končar (2020), and Salwa and Geubrina (2021). However, such research is only partly applicable to academic textbooks, because their purpose and structure differ from computer textbooks (Nokkonen-Pirttilampi, 2007). So, such researches are not introduced here. Some recent research that dealt with the TQA of Computer textbooks is briefly introduced as follows:

Nida et al. (2023) investigated computer students' skill for translating computer textbooks from English to Indonesia. For this purpose, the quality of translations was assessed based on Molina and

Albir's TQA model (2002). The results revealed that having mastery of the subject is not enough to produce an appropriate translation, and the translator needs to dominate over knowledge of linguistics and translation techniques, too.

The quality of the Finnish translations of the three Computer textbooks was assessed based on the House's TQA model by Nokkonen-Pirttilampi (2007). The assessment results revealed that a lot of omissions occurred. Omissions which changed the content or affected the clarity and readability are not reasonable because the aim of Computer textbooks is to convey technical information as efficiently and clearly as possible. Considering the detected errors, researcher categorized translation problems that translators may deal with in translation of English Computer textbooks into Finnish regarding linguistic and cultural problems. Linguistic problems contained lexical, syntax, and textual mismatches. Besides, cultural problems included the problems caused by Finnish, the textual conventions and textual preferences.

Quality of three Persian translations of the academic book entitled "Software Engineering: A Practitioner's Approach" (Pressman, 2001) was assessed by Hosseinimanesh and Dastjerdi (2013). The assessment was performed on the basis of simplicity dimension related to Göpferich's TQA model (2009). The results indicated that the literal translation and wrong equivalences lead to an unnatural ambiguous translation which might be tough to understand and even cause incorrect perception.

Anzani et al. (2021) analyzed different kinds of translation equivalences that were utilized in the translation of several computer texts from English into Indonesian based on the theory of Baker (2018). The results indicated that the most utilized translation equivalents are above word-level equivalence.

Reviewing related studies demonstrated that a few attempts have been conducted in assessing computer translation quality from English to Persian. Consequently, this research can be considered as one of the pioneers in the field of computer translation studies.

Methodology

Material

The textbook "Protocols and Architectures for Wireless Sensor Networks" by Karl and Willig (2007) (Karl & Willig, 2007), and its only Persian translation entitled "پروتکل‌ها و معماری‌های شبکه‌های حسگر بی‌سیم", by Jahanshahi (2016), were selected as materials for this research. For simplicity, this textbook and its Persian translation are respectively denominated as ST and TT. The ST provides an overview of the state of the art, challenges, and solutions of Wireless Sensor Networks (WSNs). Based on Google Scholar citations, until June 2023, it has been cited 3811 times. At the time of conducting this research, regardless of the TT, there have no other Persian translations of the ST, as a result, students have no other choices for using the Persian-translated version of the ST.

A systematic random sampling scheme was taken to select the excerpts. For this purpose, 5 percent of the ST, about 22 pages, were selected as excerpts. In this regard, every 20th page of the ST including pages 8, 28, 48, 68, 88, 108, 128, 148, 168, 188, 208, 228, 248, 268, 288, 308, 328, 348, 368, 388, 408, and 428 were selected; they were compared with their corresponding translations in the TT based on House's TQA model. Randomly selecting excerpts guaranteed that TQA was done without human subjectivity (Colina, 2008).

Due to the specific and technical nature of the ST, to detect the probable mismatches in the translation of terminologies, three highly authoritative English-to-English glossaries of computer

science were used. These glossaries are “The SNIA Dictionary” (Metz et al., 2022), “The Dictionary of Networking” (Dyson, 1999), and “The CSRC glossary” (Romine et al., 2022). These glossaries were selected because they propose definitions quoted from INCITS, ISO/IEC, and IEEE Standards (Paskauskas, 2023). Moreover, the list of approved Persian equivalents by the Academy of Persian Language and Literature (Gholam-Ali Haddad-Adel et al., 2023) was used, too. This academy is the official regulatory body for the Persian language which acts as the official authority on the Persian language.

Reliability

To satisfy reliability, aspects of repeatability and reproducibility were taken (Allen & Knight, 2009). To achieve repeatability, the quality of the excerpts was assessed, and after two weeks, excerpts were reassessed to ensure there were no differences in the frequencies and types of detecting errors. Regarding reproducibility, at the same time as the researchers, four raters assessed the quality of the excerpts to guarantee no differences were noted.

Validity

Validity was achieved by considering three aspects of face validity, content validity, and construct validity (Gass & Mackey, 2016). To satisfy face validity, excerpts were selected by using a systematic random sampling scheme. To ensure content validity, the inter-rater reliability (George & Mallery, 2011) between the participants was measured. Regarding construct validity, a Chi-Square test (McHugh, 2013) was used to measure the differences between the expected and observed detected errors.

Design

This research was designed based on descriptive and statistical analyses. In the descriptive part, TQA was done theoretically based on House’s model (House, 2014). In the statistical part, to support the results of the descriptive part, the Chi-Square test was applied, and the inter-rater reliability-Cronbach’s alpha between the participants was measured. For this purpose, the statistical package for social sciences (SPSS, version 22) was utilized. In this regard, House’s TQA model, Chi-Square test, and inter-rater reliability-Cronbach’s alpha are briefly introduced:

House introduced overt and covert types of translations for translating non-technical and technical texts, respectively. Overt translation shows the translated nature of the TT via being faithful to the ST. Covert translation hides the translated nature of the TT by producing a text that is functionally equivalent to the ST. Any deviation between the ST and TT is recognized as a mismatch, called error and can be classified as an overt or covert error. Overt errors are mismatches of omission, addition, wrong selection, wrong combination, and cases of ungrammatically and dubious acceptability. Covert errors are mismatches of dimensions between the ST and TT. To detect errors, ST and TT should be analyzed and compared based on the concepts of genre and register. Genre is described based on the occurrence of use, source, communicative intention, or any compound of these items. Register is investigated through lexical, syntactic, and textual means (House, 2014).

The Chi-square is a means taken to estimate group differences when the dependent variable is estimated at a nominal level (McHugh, 2013). Based on House’s model, TT should be translated covertly. In this regard, if there is a statistically significant difference between overt and covert errors, it can be concluded that the TT has poor translation quality. Furthermore, if there is a statistically significant difference between the different types of overt errors, it can be concluded that the TT was translated overtly.

Inter-rater reliability is a means to determine the degree of agreement between raters on ordered category scales. The degree of agreement about the values of Cronbach's alpha is illustrated in the following table:

Table 2. Degree of agreement based on Cronbach's alpha (George & Mallery, 2011)

Cronbach's alpha	**alpha ≥0.9**	**0.9> alpha ≥0.8**	**0.8> alpha ≥0.7**	**0.7> alpha ≥0**
Degree of agreement	Excellent	Good	Acceptable	Unacceptable

Procedure

In the descriptive part, TQA of the excerpts was assessed based on the House's model by participants. For this purpose, the ST was analyzed, its profile made, its genre detected, and its statement of function was obtained. The results of the ST analysis are presented in the next section. Then, the same process was repeated for the TT. Because of space limitations, the TT instances were not stated the same as the ST ones. In the following, the TT profile was compared with the ST profile. The comparative results of ST and TT profiles indicated translation errors, which were classified into overt and covert errors. Then, the frequency of occurrences of errors was calculated. In the rest, the type of the TT was recognized in accordance with the House's distinction between overt and covert translation. To remove subjectivity and for the matter of inter-rater reliability, four raters were asked to assess the quality of excerpts based on House's model. The aim of cooperating with raters was a replication of the research in identical situations to see whether the same results were achieved or not. One of the raters was an associate professor in the field of applied linguistics and was familiar with the technical vocabulary of computer science. The other one was a Ph.D. in computer engineering and was fluent in the English language. The other two raters were bilinguals, professional translators, and language teachers. In the statistical part, by using the Chi-square test, the differences between observed and expected frequencies of overt and covert errors were calculated. In addition, the degree of agreement between the participants was measured. Finally, based on the assessment results, answers to the research questions were presented.

Results

Descriptive Analysis

ST Analysis Based on Register and Genre

Register includes the dimensions of field, tenor, and mode. Field contains the subject and social action. In this regard, lexical 'Means' implied the existence of a specific lexicon that specifies that the ST belongs to computer science, for instance: "wireless networks", "CSMA", and "TinyOS". Syntactic 'Means' indicated the frequent use of passive voices such as: "is coupled", "have been devised", and "is then defined". Furthermore, it demonstrated frequent use of well-structured and complex sentences. Based on the textual means, a strong cohesion was gained through the use of the additive, adversative, alternative, causal, explanatory, and illative relations between clauses such as: "although", "thus", "so that", "but", "however", "not only", "but also", "as well as", and "therefore". Moreover, it manifested that theme dynamics was achieved by repetition of terminologies, use of different typography styles, font sizes, footnotes, anaphoric references, conjoined, clausal, and iconic linkage. Consequently, the ST analysis based on the field revealed that:

Table 3. ST profile: Field

Subject Matter	Social Action
Technical	Specific

Tenor covers the author's provenance and stance, social role relationships, and social attitude. Both authors' stances are as follows: Holger Karl is chairman of the Networks Research Group, at Paderborn University. Andreas Willig is a Professor of Computer Networking at the University of Canterbury, Christchurch, New Zealand. The authors wrote the ST in such a way that it does not relate to the world of emotion and literary works. The ST's style and content are innovative yet practical and enjoyable. The main attempt of the authors was focused on putting the reader in a situation where they feel that they are in the classroom and listening to the lectures of their instructors. The social attitude of the ST was formal and marked by impersonality, because it was written for the education and edification of the readers. In this regard, lexical means illustrated lack of using emotive and metaphoric expressions. Computer terminologies were defined clearly. Moreover, imperative terms such as "need to", "must be", and "has to" were heavily used. Syntactic means declared frequent use of compound and complex sentences. Authors also used subject noun phrases to add impersonal characters to the different components of networks. Moreover, the authors used illocutionary force statements to show their authority. Inclusive "we" were used to refer to the authors as network experts. Furthermore, in several cases, the pronoun "you" was used to evoke the imagination of the readers and enhance the persuasiveness of the text. Textual means demonstrated lack of foreground thematic structure to avoid the emotive effect. As a result, the ST analysis based on the tenor highlighted that:

Table 4. ST profile: Tenor

Author's Personal	Social Role Relationship	Social Attitude
Unmarked, Contemporary Educated Standard American English	Asymmetric	Formal

Mode contains the medium and participation. The ST was written to be read. Furthermore, the ST's medium is strongly informational, explicit, and abstract. In addition, the readers' reactions were never directly elicited, and their participation was not explicit. In this regard, lexical means manifested the absence of emotive lexical items, interjections, qualifying modal adverbial expressions, and other subjectivity markers which support the formal aspect of the ST. Syntactic means demonstrated the absence of elliptical clauses, contractions, anacolutha, and other spoken language signals such as "well", "you see", and "you know". Moreover, by using formal writing through passive voice sentences, the authors added impersonality to the ST. Textual means confirmed that the ST is full of links to related references and introduces correspondence references for further study. Thus, in accordance with the distinction between the types of "emic" and "etic" texts, the ST is etic. With these explanations, the ST analysis based on the mode asserted that:

Table 5. ST profile: Mode

Medium	Participation
Simple	Simple and etic

Statement of Function

Genre of the ST is technical-scientific and concentrates on different aspects of WSNs. Thus, its ideational function is strong, while the interpersonal function remains in the background. Regarding the field, the presence of technical expressions, long, compound, and complex sentences, repetition of key terms, use of cohesive devices, and absence of figurative language contribute to the ideational function. The presence of short clauses and phrases with simple structure, using different typography styles, and applying strong textual cohesion make the ST pleasant for readers which supports the interpersonal function. Regarding the tenor, there is no evidence of the emotional and intellectual stance of the authors, which denotes the ideational function. The asymmetrical social role relationship and formal social attitude amplify the ideational function. Furthermore, using the pronoun "we" illustrates the interpersonal function. Using the pronoun "we" helped authors build a collective relationship with readers and accordingly with the targeted academic community. Expressing rhetorical questions to evoke the readers' attention, highlights the interpersonal function. The features of the medium such as simple monologue, strongly informational, explicit, and abstract confirm the ideational function. Moreover, lack of overt participation with readers reveals the ideational function.

Identifying Covert Errors

Regardless of one mismatch, all aspects of the dimensions of the ST were preserved in the TT. The detected mismatch is a tenor mismatch between the authors' provenance and stance (instructors in American universities and authors of computer science textbooks) and that of the translator's (instructor in Iranian universities and Persian translator).

Since the authors and the translator are different persons, the existence of a mismatch between the authors' provenance and stance and that of the translator is natural. Moreover, this mismatch does not distort the purpose of the ST. Therefore, this difference should not be considered a mismatch.

Identifying Overt Errors

Overt errors refer to the mismatches of omission, addition, wrong selection, wrong combination, and cases of ungrammatically and dubious acceptability. In the following, several instances are introduced and discussed. It is necessary to state that in each excerpt, in addition to the discussed type of overt error, there may be other types of overt errors that are not addressed.

- Omission

Omission errors are those missing parts that were not translated. In the following excerpt, the adverbs "considerably" and "substantially" were not translated. These adverbs are synonyms and have been defined as "much; a lot". Their suggested equivalents can be "خیلی؛ بسیار".

Excerpt 1: In some extreme cases, an entire sensor node should be smaller than 1 cc, weigh (considerably) less than 100 g, be substantially cheaper than US$1, and dissipate less than 100 μW.

ترجمه: در بعضی موارد افراطی، کل اندازه یک گره حسگر باید کمتر از 1CC، وزن آن کمتر از ۱۰۰ گرم و قیمتش کمتر از یک دلار آمریکا باشد. همچنین میزان اتلاف انرژی آن کمتر از 100 μW باشد.

- Addition

Addition errors occur when the translator adds extra elements that are not there in the ST. For instance, the adverb "البته" [of course] is not there in the excerpt 2.

Excerpt 2: The long read and write access delays of flash memory should be taken into account, as well as the high required energy.

ترجمه: البته باید تاخیر طولانی دسترسی خواندن و نوشتن حافظه‌های Flash و همچنین انرژی مورد نیاز زیادشان را نیز در نظر داشت.

- Wrong Selection

Wrong selection errors refer to using inappropriate equivalents or applying foreignization translation techniques such as calque and borrowing when sensible equivalents are there. In the following excerpt, although the adjective "excessive" means "greater than what seems reasonable or appropriate", it was translated into "بالا" which is a wrong selection mismatch. The term "بیش از اندازه" is suggested as its equivalence.

Excerpt 3: These processors are highly overpowered, and their energy consumption is excessive.

ترجمه: مصرف این پردازنده‌ها بشدت بالاست.

- Wrong Combination

Wrong combination errors refer to using a sequence of inappropriate equivalents. In excerpt 4, translating the term "old-fashioned mainframes" into "Mainframe کامپیوترهای قدیمی" is a wrong combination mismatch. The suggested equivalent is "ابر رایانه‌های قدیمی".

Excerpt 4: The most common form of information processing has happened on large, general-purpose computational devices, ranging from old-fashioned mainframes to modern laptops or palmtops.

ترجمه: رایج‌ترین شکل پردازش اطلاعات در وسایل محاسباتی همه‌منظوره و بزرگ، از کامپیوترهای قدیمی Mainframe گرفته تا لپ‌تاپ‌های مدرن یا تبلت‌ها، رخ داده است.

- Ungrammatically

Ungrammatical errors refer to clear breaches of the TL system. In the following excerpt, translating the article "the" in the phrase "the simple, direct communication…" into "یک ارتباط ساده و مستقیم ..." is an ungrammatical mismatch. The phrase "ارتباطی ساده و مستقیم ..." is suggested as an appropriate equivalent.

Excerpt 5: Because of this limited distance, the simple, direct communication between source and sink is not always possible.

ترجمه: به علت این محدودیت فاصله، برقراری یک ارتباط ساده و مستقیم بین منبع و سینک همیشه امکان‌پذیر نیست.

- Dubious Acceptability

Dubious acceptability errors refer to breaches of the norm of usage. In the following excerpt, using the term "دریافت‌کننده" as equivalent for "receiver" is a dubious acceptability mismatch. In Persian telecommunication engineering texts, using the term "گیرنده" is more prevalent.

Excerpt 6: A receiver has to offer certain services to the upper layers, most notably to the Medium Access Control (MAC) layer.

ترجمه: یک دریافت‌کننده باید سرویس‌هایی را به لایه‌های بالاتر به خصوص لایه MAC ارائه دهد.

Frequency of Occurrences of Overt Errors

The frequencies and the percentages of the detected overt errors are presented in the following table:

Table 6. Frequencies and percentages of detected overt errors

No.	Types of Overt Errors	Frequency	Percentage
1	Omission Mismatches	86	23.24
2	Addition Mismatches	26	7.03
3	Wrong Selection Mismatches	155	41.89
4	Wrong Combination Mismatches	29	7.84
5	Ungrammatically Mismatches	40	10.81
6	Dubious acceptability Mismatches	34	9.19
Total		370	100

As can be found from the table 5, forty-one & eighty-nine hundredth percent (41.89%) of overt errors belonged to wrong selection mismatches, which may lead to conveying incorrect information to the readers. Twenty-three & twenty-four hundredth percent (23.24%) of overt errors belonged to omission mismatches, which may leave the readers confused and not knowing what to think or to do next. Ten & eighty-one hundredth percent (10.81%) of the overt errors belonged to ungrammatical mismatches. Incompatibility between tenses in ST and TT, changing roles of terms, wrong translations of articles and pronouns, spelling mistakes, punctuation errors, wrong collocation, and incorrect use of ellipsis are some of the ungrammatical errors that were observed in the TT. Nine & nineteen hundredth percent (9.19%) of overt errors belonged to dubious acceptability mismatches. Using informal expressions and inappropriate terms that are not common in the Persian language or academic style of writing are some of the dubious acceptability errors that were observed in the TT. Seven & eighty-four hundredth percent (7.84%) of overt errors belonged to wrong combination mismatches. These errors might occur because of using inappropriate equivalences or ignoring the rules of word collocation in the TL. Seven & three hundredth percent (7.03%) of overt errors belonged to addition mismatches. In most cases of addition errors, the extra elements that were inserted into the TT were neither necessary nor justifiable.

Statistical Analysis

Chi-Square Test

To find out whether there is a statistically significant difference between the frequencies of overt and covert errors on one side, as well as between different types of overt errors on the other side, the Chi-Square test was employed as follows:

Difference Between Frequencies of Covert and Overt Errors

Tables 6 and 7 demonstrate a statistically significant difference between covert and covert errors. Consequently, it can be stated that taking into account the rather high frequency of observed errors, the TT has poor translation quality.

Table 7. Observed and Expected Frequencies of Covert and Overt Errors

	Observed N	Expected N	Residual
Covert Errors	1	185.5	-184.5
Overt Errors	370	185.5	184.5
Total	371		

Table 8. Test Statistics

	Frequencies
Chi-Square	367.011[a]
df	1
Asymp. Sig.	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 185.5.	

Difference Between Frequencies of Different Types of Overt Errors

Tables 8 and 9 demonstrate a statistically significant differences between different types of overt errors at 95% and 99% probability levels. Consequently, it can be stated that the TT was translated overtly.

Table 9. Observed and Expected Frequencies of Different Kind of Overtly Errors

	Observed N	Expected N	Residual
Omissions Mismatches	86	61.7	24.3
Addition Mismatches	26	61.7	-35.7
Wrong Selection Mismatches	155	61.7	93.3
Wrong Combination Mismatches	29	61.7	-32.7
Ungrammaticality Mismatches	40	61.7	-21.7
Dubious Acceptability Mismatches	34	61.7	-27.7
Total	370		

Table 10. Test Statistics Result

	Frequencies
Chi-Square	208.822a
df	5
Asymp. Sig.	.000
a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 61.7.	

Inter-Rater Reliability

Based on the House's TQA criteria, researchers and raters assign a score out of 20 to each excerpt's translation. The degree of agreement in assigning scores to translations between researchers and raters according to Cronbach's alpha which is illustrated in the following table:

Table 11. Reliability Statistics

Cronbach's alpha	**Cronbach's alpha Based on Standardized Items**	**N of Items**
0.990	0.991	6

The degree of agreement between researchers and raters indicated that the research was performed without probable subjectivity and its results are reliable.

Answers to the Research Questions

Regarding achieved results from both theoretical and statistical analyses, answers to the research questions can be given as follows:

Question 1: How was the TT translated overtly or covertly?

Answer: By reading the TT, the readers recognize that what they are reading is not the original textbook, and they are reading a translated version of the original textbook. Furthermore, on one side, the most terminologies were directly transferred to the TT by using foreignization translation techniques in the form of borrowing, loaning, and word-for-word translation; however, sensible Persian equivalents were there. Since foreignization is SL-oriented and preserves the foreign flavor of the ST, using foreignization translation techniques demonstrates that the TT was faithfully translated into the ST (Mozaheb et al., 2021). It is worth mentioning that using such techniques demonstrates overt translation (Barkhordar & Fatemi, 2020). As a result, it can be concluded that the TT was translated overtly. On the other side, the results of Chi-Square statistical test revealed that there is a statistically significant difference between the two kinds of errors, i.e., covert and covert errors; as well as between the different types of overt errors. As far as the former is concerned, it can be claimed that taking into account the rather high number of observed overt errors, the TT has poor quality. Regarding the latter, it can be concluded that the TT was translated overtly rather than covertly.

Question 2: Which kinds of covert errors were made in the TT?

Answer: Only one situational dimension mismatch between the ST and TT was detected, which was a tenor mismatch between the authors' provenance and stance (instructors in American universities and authors of computer science textbooks) and that of the translator's (instructor in Iranian universities and Persian translator).

Question 3: Which kinds of overt errors were made in the TT?

Answer: All types of overt errors were observed in the TT. The frequency of each type of overt error is presented in Table 5.

Results and Discussions

The TT was translated by Mohsen Jahanshahi, a Professor of Computer Networking at the Islamic Azad University, Central Tehran branch. Although he has mastery and expertise on the ST subject, the TT has low translation quality. As a result, it can be concluded that the familiarity of the translator with the subject of ST does not mean that the translator can translate it appropriately. It emphasizes that the translator should also have knowledge of linguistics and be familiar with translation techniques. A similar conclusion was provided by Nida et al. (2023). They stated that to translate computer texts, the translators should know linguistics, at least about the unit of language. The reason is that wrong equivalences can occur with the change of language unit.

The ST is a textbook based on which the students must learn and work. Thus, it should be translated in a way that is readable and understandable for readers. However, the TT does not sound natural and idiomatic, because it is too faithful to the SL and does not tie to the TL. Being extremely faithful to SL, the translator forgot that a complicated sentence could be translated into a simple form. In addition, in several cases, the translator did not consider the preferred equivalents based on the context and selected the dictionary meanings. Besides, the translator omitted several meta-texts the authors used to make the text easy to follow. These omissions degraded the readability of the TT. Similar findings were reported by Nokkonen-Pirttilampi (2007) in TQA of computer texts from English to Finnish.

Since the translator preserved the ST's main idea and stance, the detected mismatch between the authors' provenance and stance and that of the translator's was not considered a covert mismatch. The same reasoning was provided by Halim (2017), and Kortman (2017).

Vast numbers of wrong selection errors and the overt kind of translation both indicate that TT has low quality. Furthermore, the presence of breaches of the target language system makes the TT unnatural and difficult to understand. These findings are in line with the previously reported results by Hosseinimanesh and Dastjerdi (2013).

Some translation theorists argue that TQA is an effort to fill the gap between translation theories and products (Meylaerts & Marais, 2023). This research attempted to take a humble step forward by considering the aforesaid gap. Considering the House's TQA model, the TT does not meet the requirements of academic translations and needs to be edited for subsequent publication. To edit the TT, cooperation of professional translators, computer specialists, and Persian editors is required.

Conclusion

This research attempted to shed light on assessing computer texts translation quality from English into Persian. In this regard, the quality for the only Persian translation of the book entitled "Protocols

and Architectures for Wireless Sensor Networks" was assessed based on House's TQA model. The assessment results revealed that Persian translation was translated overtly rather than covertly. Moreover, it had low translation quality. As a result, it does not fulfill the House's criteria, and could not be considered an adequate translation. Furthermore, the obtained results highlighted that to achieve an adequate translation of a computer text, mastery of the source and target language, as well as mastery of the subject matter of the text is needed. That is why translating computer texts is a hard task to do, and assessing their translation quality is even harder and more problematic.

To the best of the researchers' knowledge, a few attempts have been conducted in TQA of computer texts, especially from English to Persian. Therefore, this research is one of the pioneers in assessing the translation quality of computer texts. Due to the practicability of this research, it can be used in many respects, such as:

- It can be used as a schema in the TQA of technical texts, especially computer texts.
- It can be used in learning and teaching of technical texts translation, especially computer texts.
- It can be used by translators who want to improve the quality of their translation, especially the translation of computer texts.

Despite the significance of assessing the technical texts translation quality, especially computer texts, this field of translation studies is under-researched and discussed. As a result, this research opens room for further research, such as:

- Assessing the quality of the Persian translation for other textbooks in computer science to identify the common translation errors in the computer texts translation from English to Persian.
- Assessing the translation quality of the Persian translation based on quantitative TQA models such as SICAL (Larose, 1998), LISA QA (Welcom et al., 2022), and SAE J2450 (Bradley et al., 2022) and comparing the obtained results with results of this research.
- Assessing the translation quality of the Persian translation based on other qualitative TQA models such as Williams (2001), Baker (2018), Farahzad (2003), and Newmark (1993), then comparing the obtained results with results of this research.
- Assessing different technical texts translation quality translated by Machine translations, and providing constructive feedback to increase the learning speed of artificial intelligence of Machine translations. It is worth mentioning that providing constructive feedback which is helpful in Pattern Recognition to accelerate deep learning, needs the cooperation of experts in the fields of computational linguistics and Artificial Intelligence (Mondal et al., 2023).

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