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MANUSCRIPT LANGUAGE NORMS IN TRANSLATING SCIENCE ARTICLES

A science article, as one of the leading genres in the scientific discourse, is becoming increasingly significant in modern science communication. It allows the wide audience to learn about the newest research results in various fields of science and technology. New scientific information is shared around the world mostly through translations. A particular research interest is taken in the quality of translation of science papers and the conformity of target texts to the scientific language norms. In Ukraine, there is a current need for highly-qualified translators of scientific texts into English, who can help the author of a science article to present worldwide new research results. It is important for translators to be knowledgeable about the basic rules of transition from the source to the target language, in rendering science texts. To take a rational translation solution, the translator should be competent in using translation devices and bring the source text into accordance with the norms of the language of science. The translator should be trained enough in the branch of knowledge the translation texts belong to. Our analysis of the Ukrainian-English translations of science articles in physics aims to establish the degree of equivalence of source and target texts and to evaluate the translation solutions that were chosen to achieve the text equivalence. The special research attention has been paid to the stylistic features of the language of science and the basic rules of manuscript language that should be a guide for a translator of scientific texts.

Keywords: *science article, characteristic features of scientific writing, manuscript language norms, degree of translation equivalence, Ukrainian language, English language*, *translation solutions, translation techniques.*

Introduction. The growing role of science in the life of the modern society and the role of the English language as the universal form of communication in science account for the increased interest in scientific English. One of the leading genres of the scientific discourse is a science article, in which a scholar can publish the newest research results, in an international journal in particular.

It is especially important for the author of a science article to know the English language and to be able to use it in science communication. However, not all scientists have a good command of English and they use translator's services. Ukraine currently needs highly-qualified translators of scientific literature who can help the author of a science article to present worldwide the results of his/her research.

Apart from the basic professional competences, a translator of a science article needs to be aware of the main stylistic features of scientific English and the manuscript language norms, in particular. Even if the author of a scientific text does not follow the general scientific writing guidelines in his native language, the translator's task is to bring the target text in conformity with the norms of the language of science.

The novelty of our research is the analysis of Ukrainian-English translations of scientific articles in physics. The goal of this paper is to establish the degree of equivalence of source and target texts (in language and style) and to evaluate the translation solutions (in selected text fragments) that were applied to achieve the text equivalence. The task is to analyse the translation techniques that helped the translator to bring the source text in conformity with scientific language norms. In this work, we also highlight the main stylistic features of the language of science and the rules of manuscript language that a scientific translator must be guided with.

Characteristic features of scientific writing. It is common knowledge that to produce a successful translation of a scientific research article, the translator himself needs to have a good command of the language of science. For a translator of scientific texts, it is essential to know the main features of scientific English. As viewed by P. Strevens [20, 21], scientific English is simply English used by scientists. It has the same grammar, pronunciation and spelling as are found in all kinds of English. Scientific English includes much of the general vocabulary of English, though with a large number of specialized items or of familiar words used in specialized ways.

What is special about scientific prose is a particular mixture of grammatical and vocabulary items typically found in scientific

English. They may display an array of features, such as rather long sentences with many clauses; long and complicated noun-phrases, frequent passive constructions, a high proportion of items of specialised vocabulary. Scientific discourse uses a lot of words, roots and affixes of Greek and Latin origin, and symbols, numbers, names of chemicals, etc., which are largely international in character [21].

A valuable source of information for a translator of science texts are English-language style guides on scientific manuscript writing [26, 25, 24, 22, 19, among others]. They provide general recommendations regarding the style and use of English in science papers.

Some of the basic rules of manuscript language that a scientific translator should observe in rendering a science article into English are overviewed in work [7]. The authors state that manuscript language should be accurate, concise, clear, and objective. Special care should be taken in using proper tenses when describing a scientist's work and his/her findings. The present tense is preferable for known facts and hypotheses. Past tense should be used for describing experiments that have been conducted and the results of these experiments. Another grammar tip is to use the active voice to shorten sentences and make them more dynamic and interesting for the reader.

It is also noted that to write a successful manuscript, authors first should be aware of the sentence structure they use [7]. Direct and short sentences are preferable. The average length of sentences in scientific writing is only about 12–17 words, with only one piece of information per sentence included. Sentences should be constructed in short, factual bursts, as long and complicated sentences tend to confuse readers. Sentences should be linked together within a paragraph to provide a clear story-line. Authors should keep related words together and closely place the subject and verb to allow the reader to understand what the subject is doing. Special attention should be paid to the order in which a sentence is written. The *stress position* within a sentence contains new information to be emphasized. The *topical position* contains "old" information leading up to the point of emphasis. The topical position comes before the stress position. Redundant words or phrases should be eliminated: due to the fact that *should be replaced with* because *or* since, in order to determine – to determine, in the case that – in case [7].

Thus, one of the major components of a scientific translator's competence is the knowledge and observance of basic scientific language norms. Other important factors for delivering high quality scientific translations are a translator's strong knowledge of science vocabulary, terms, terminological phrases, grammar, style, translation techniques, and practical experience in translating from related fields. All of these components help the translator in search of solutions for reaching the equivalence of source and target texts.

Translation equivalence. The idea of equivalence forms the basis of many theories of translation and by implication, definitions of translation quality. But the term "equivalence", however, is fraught with difficulties. While there are numerous definitions and types of equivalence, they all rely on one thing: a link or bond of some sort between the source text and target text [5, p.25].

Equivalence is the core concept in translation quality assessment. As a necessary condition for translation, it is, on the one hand, a balanced correlation between the two most important characteristics of source texts and target texts – completeness and accuracy of the meaning being rendered. On the other hand, it is a sameness of pragmatic impact of the original text on its own reader and that of the translated text on its reader [13, p. 43]. Reaching absolute equivalence, in all its aspects – syntactic, semantic and pragmatic – is practically impossible and, sometimes, even unwelcome, as it can cause the misbalance of impact on the reader of the original and translated texts. Regarding the syntactic equivalence, it is hardly a translator's target to preserve the structure of the source text. In many cases, this will violate syntactic and stylistic norms of the target language. Semantic similarity between the source and target texts is desirable, but it is not the main goal of a translator. What is really important is to reach the pragmatic equivalence and to find an optimal balance of semantics and form in the source and target texts.

As stated in work [13, p. 43], equivalence-based translation theories, along with translation quality assessment procedures, have been proposed by such scholars in the field, as J. P. Vinay and J. Darbelnet [23], R. Jakobson [10], E. Nida and Ch. Taber [15], J. Catford [6], J. House [9], W. Koller [12], P. Newmark [14], A. Pym [16], among others.

Translation equivalence issues, in particular source- and target-oriented approaches to translation, and the issue of how theory can help in solving translation problems, have been widely discussed by many translation theorists [1, 2, 3, 4, 5, 8, 11, 18].

Equivalence can be measured by a scale that ranges from optimum equivalence to zero equivalence (optimum translation, near-optimum translation, partial translation, weaker and stronger translation, poor translation, mistranslation and zero equivalence/non-translation). While optimum equivalence is considered as the highest level in translation, or the most approximate degree from the source text goal, zero equivalence is viewed as the lowest degree or the most distant degree from the source text goal [13, p.43].

In achieving the equivalence of the source and target texts, a translator can use numerous translation techniques, or *translation solutions* [17]. They depend on a translator's expertise, particularly, on his/her ability to make necessary lexical and grammatical transformations in solving practical problems that arise in the process of translation.

The comparative analysis of source and target texts. In our study of the Ukrainian language scientific journal articles in physics and their English language translations (the translator O. Voitenko), we analysed the translation solutions that were chosen to adequately render the articles in the target language. We also took a close look at the transformations the translator made to bring the source text into accordance with the norms of the language of science. The special research attention was paid to lexical and grammatical translation peculiarities that are of immediate practical interest for a translator of scientific texts.

The analysis has shown that, in most cases, the translation solutions in the articles are well-grounded. They serve the purpose of achieving maximum possible equivalence of the source and target texts and could be used as translation models. We mostly observed optimum and near-optimum equivalence, with rare cases of partial translation. However, there are some mistranslations, which, in our view, need corrections due to semantic and formal losses.

Structurally, the stylistic features of a science article – tables, figures, formulas and graphs – were reproduced accurately.

Regarding the vocabulary, the analysed articles were translated with a high degree of equivalence – optimum equivalence. Special physics terms and general science lexis were rendered through monosemantic (Fragments 1, 2) and variational (Fragment 3) equivalents, respectively. Compression was an efficient language economy solution: two-word Ukrainian terms were replaced with one-word English terms, as in Fragment 3 ("виконувати аналіз" – "to analyse") and Fragment 4 ("радіаційне опромінення" – "irradiation"):

1. *У **границі сильного зв'язку** перший доданок в (2) відповідає кінетичній енергії електрона в фононному полі [32, с.1090].* – In **the strong-coupling limit**, the first term in Eq. (2) plays the role of the kinetic energy of an electron in the phonon field *[31, p.1089].*

2. *Отримання енергії зводиться до усереднення функціонала* **П** *на **власних функціях** оператора (1) з подальшою мінімізацією по f_k [32, с.1090].* – The determination of the energy is reduced to the averaging of the polaron functional over the **eigenfunctions** of operator (1) and the following minimization over $\boldsymbol{f_k}$ *[31, p.1089]*.

3. ***Результати експериментальних досліджень*** не дозволяють **виконувати** на мікрорівні детальний **аналіз** впливу радіаційного опромінення на структурні, енергетичні та динамічні **властивості** досліджуваних систем [28, с. 422]. – ***The results of experimental researches*** *do not allow one to **analyze** the influence of radiation on the structural, energy, and dynamic properties of examined systems in detail at the microscopic level* [27, p. 422].

4. Одним із найменш досліджених зовнішніх чинників, які суттєво впливають на властивості водних розчинів солей електролітів, є **радіаційне опромінення** [28, с. 422]. – *Irradiation is one of the least studied external factors that considerably affect the properties of the aqueous solutions of electrolyte salts* [27, p. 422]**.**

Proper names were transcoded appropriately, for example:

5. *Варіаційним методом знайдено значення енергії досліджуваних систем для проміжних значень фрьоліховської константи електрон-фононного зв'язку* $4 \le \alpha \le 20$ [32, с. 1089]. – *Variational solutions are found for the energies of the systems under study in the case of the intermediate values of **Fröhlich** electron-phonon coupling constant,* $4 \le \alpha \le 20$ [31, p. 1089].

With regard to grammar, the translations are mostly optimum, near-optimum, partial and they generally conform to the science language norms. For this, the translator found appropriate solutions in each case and made necessary lexical and grammatical transformations. Thus, for example, the translated texts preserve text cohesion – cohesive words and phrases were rendered with proper target language equivalents:

6. ***Додамо, що,*** *використовуючи поняття елементарного кластера, ми ніде не використовуємо його конкретну структуру [30, с. 142]. –* ***Furthermore****, when using the notion of elementary cluster, we do not consider its specific structure anywhere [29, p. 144].*

Most of the translation solutions brought syntactic changes. He translator used techniques that reduce the sentence length in the translated text – sentences in Ukrainian science articles are normally longer. For instance, long sentences were split, where necessary, as in Fragment 7:

7. *Вона [молекула води] може бути віднесеною або до однієї молекули етанолу, або до іншої, тобто на молекулу етанолу в середньому припадає 12–13 молекул води* [30, с. 141]. – *This water molecule can be attributed to either of those ethanol molecules. As a result, there are on average 12–13 water molecules per one ethanol molecule* [29, p. 143].

Another strong point of the translations is elimination of word redundancy. The following example demonstrates the use of a simple verb *instead of a* noun-verb phrase:

8. Внаслідок електростатичного прискорення **відбувається зменшення** ефективної температури прискореного пучка [36, с. 741]. – *Due to the electrostatic acceleration, the effective temperature of an accelerated beam* ***is reduced*** [35, p. 742].

9. Детальна інформація про локальну структуру і властивості водних розчинів електролітів може бути **одержана шляхом аналізу** енергетичних властивостей досліджуваних систем [28, с. 424]. – *The network of hydrogen bonds between interacting particles is* ***analyzed*** *on the basis of the following criterion* [27, p. 422].

Wordiness is a serious problem that scientific writing suffers from. T*o curb wordiness,* the authors of the scientific English style

guide [24] recommend doing an exercise *on replacing verb-noun phrases by simple verbs, for example:* make a decision – decide, experience failure – fail, place under consideration – consider, perform an experiment – experiment, give indications of – indicate, etc. *A clean, direct style shows respect for reader's time.*

The following fragment is another example of language economy, where the translator used a shorter paraphrase:

10. ***Це можна переформулювати еквівалентно****: лише частина молекул етанолу утворюватиме елементарні кластери, а інша їхня частина залишатиметься некластеризованою* [30, с. 142]. – ***In other words****, only some of ethanol molecules participate in the formation of elementary clusters, whereas the others remain unclustered* [29, p. 144].

A solution that also shortened the target sentence was the use of the subject-infinitive construction peculiar of the English grammar system:

11. **Як відомо,** значну роль в процесах, що розгортаються в магнітосферах планет, **відіграють** так звані подвійні електричні шари *[14–21]* [36, p. 740]. – *The so-called electric double layers [14–21]* ***are known to play*** *an important role in the processes running in the magnetospheres of planets* [35, p. 741].

To reduce the sentence length, the translator skilfully replaced a clause with a preposition:

12. *Об'єм спирту,* ***що не належить до складу кластерів****, визначається таким виразом* [30, с. 143]. – *The volume of alcohol molecules* ***beyond the clusters*** *is determined by the expression* [29, p. 145].

The following fragment also illustrates a sentence compression, where one-word adverb is used instead of a clause:

13. *Це значить, що теплова складова ентальпії,* ***як і повинно бути****, є додатною [30, с. 145]. – This fact means that the heat component of the enthalpy is* ***expectedly*** *positive* [29, p. 147].

On the other hand, there are cases of sentence decompression, when, for example, the translator expanded the noun phrase to a clause. This was done to avoid far too literal translation:

14. **За енергій радіаційного опромінення**, більших ніж 9 МеВ, збільшення числа найближчих сусідів не перевищує

похибку визначення N_z *[28, с. 426]. – If the irradiation energy exceeds* ***9*** *MeV*, ***the increment in the number of nearest neighbours does not exceed the error of the determination of*** N_z [27, p. 426].

A successful translation solution is the use of the modulation technique (Fragments 15 and 16):

15. Зазначимо, що **концентрація** $n_f(x)$ **залежить від координати неявно**, тому її можна вважати функцією потенціалу $\varphi(x)$ [36, с. 742]. – *Note* ***that the concentration*** $n_f(x)$ ***is an implicit function of the coordinate****, so that it can be considered as a function of the potential* $\varphi(x)$ [35, p. 743].

16. Показано, що **наявність подвійного плазменного шару** в ділянці підошви струмової трубки Іо **забезпечує формування** щільних холодних висхідних електронних згустків, для яких можливий фазовий перехід до режиму ЦНВ [36, с. 744]. – *It is shown that* ***the plasma double layer*** *in the region of the Io flux tube foot* ***is responsible for the formation*** *of dense cold electron bunches moving upward, for which a phase transition into the CSR mode is possible* [35, p. 745].

Note that modulation is possible only when the translator has a clear understanding of the subject matter of the source text. The above text fragments show that the translator is very knowledgeable and experienced in physics.

Having no direct Ukrainian equivalents, gerund in an English sentence is also very productive in reducing the sentence length:

17. *Подібний висновок робиться також у роботі [42], у якій локальна структура водних розчинів етанолу вивчається* ***за допомогою*** *комбінаційного розсіювання світла та комп'ютерного моделювання [30, с. 146]. – A similar conclusion was also made in work [42], where the local structure of aqueous ethanol solutions was studied,* ***by using*** *the Raman light scattering and computer simulation* [29, p. 148].

The use of simple modal verbs instead of modal clauses is also recommended in scientific English to simplify the sentence structure:

18. ***Можливо, що*** *наше припущення про формування кластерів лише одного типу є дещо спрощеним [30, с. 146]. – Our assumption that the clusters of only one type are formed* ***may probably*** *be somewhat oversimplified* [29, p. 147].

The use of active voice instead of passive also shortens the sentence in translation. *The following text fragment demonstrates how the impersonal passive sentence is personalised, what "enhances the sense of immediacy between writer and reader"* [24]*:*

19. *Тут* ***приймається, що*** *з погляду термодинаміки, надлишкова ентальпія розчину визначається об'ємною та тепловою складовими [30, с. 144]. – Here,* ***we assumed that****, from the thermodynamic viewpoint, the excess enthalpy of a solution is determined by the bulk and thermal components* [29, p. 146].

However, some active sentences were replaced with passive ones, in which the object of the source sentence became the subject of the target sentence. This also served the purpose of reducing the sentence length:

20. Після чого **на один із іонів системи діяло опромінення** зі значенням енергії у інтервалі 0–12 МеВ, яка розподілялась рівномірно за усіма вісями координат *[28, с. 423]. –* ***Afterward,*** *one of the ions* ***in the system*** *was subjected* ***to the irradiation*** *with an energy in the interval of 0–12 MeV; the energy was equally distributed along all coordinate axes* [27, p. 423].

Noun clusters help avoid the use of "of-of" constructions and shorten the target sentence:

21. Зауважимо, що конкретна форма функції розподілу пучків є наслідком штучного вибору **модельного профілю потенціалу подвійного шару** *[36, с. 744]. – Note that the specific form of the beam distribution function is a consequence of the artificial choice of the* ***model double-layer potential profile*** [35, p. 745].

However, some clusters formed by the translator were too long and difficult to understand:

22. Висока потужність циклотронного надвипромінювання дозволяє розглядати його як основний механізм **генерації декаметрового випромінювання Юпітера** у вигляді S-сплесків *[36, с.* 739]. *– A high power of cyclotron superradiance allows it to be considered as the main mechanism of* ***decameter Jupiter radiation generation*** *in the form of S-bursts* [35, p. 740].

In our view, the translation could benefit from using a clause instead of the noun cluster – "the mechanism that generates Jupiter's decameter radiation".

In most cases, the translator made complex lexical and grammatical transformations, as in Fragment 23:

23. *Ліворуч від неї, ступень кластеризації зменшується* ***внаслідок намагання води зберегти*** *свою льодоподібну структуру, праворуч все відбувається навпаки –* ***свою локальну структуру намагається зберегти спирт*** *[30. с. 146]. – To the left from the singular point, the clustering degree decreases,* ***because water tries to preserve*** *its ice-like structure. To the right from the singular point, the situation is inverse:* ***it is the*** *alcohol* ***that*** *tries to preserve its local structure* [29, p. 148].

In the above text fragment, with the purpose of sticking to the science language norms, the translator divided a long sentence into two shorter ones, used a verbal clause ("because water tries to preserve its ice-like structure") and an emphatic construction ("it is the alcohol that tries to preserve its local structure").

Necessary syntactic transformations were skilfully made by the translator to rearrange the sentence according to the English language subject-verb order – in the Ukrainian sentence, the word order is less fixed:

24**.** ***Встановлено****, що при величинах* E_r*, менших або більших за 9 МеВ,* ***не відбувається кардинальної зміни*** *локальної структури дослідженої системи [28, с. 422]. – No substantial changes in the local structure of the solution were found at energies Er higher or lower than 9 MeV* [27, p. 422].

To bring the source sentence to the subject-verb order and to avoid extensive syntactic transformations, the translator used the formal subject "there":

25. *Гострий симетричний пік, який спостерігався на рис. 1, втрачає симетричність та розширюється: крім електронних кореляцій ще* ***виникає ефективне відштовхування*** *від площини поділу (див. рис. 2) [34, с. 1111]. –* ***The sharp symmetric peak that was observed in Fig. 1 loses its symmetry and broadens: besides electron correlations,*** *there emerges* ***an effective repulsion from the interface (see Fig. 2)*** [33, p. 1110].

The formal subject "there", which is frequent in the language of science, also helps avoid placing the verb too far from the subject, in conformity with the target language word order:

26. *Отже,* ***виникає необхідність*** *побудови нової теоретичної моделі напруженої наногетероструктури з КТ, яка б враховувала перенормування енергетичного спектра квантової точки під впливом самоузгодженої електрон-деформаційної взаємодії [38, с. 1099].* – Hence, **there emerges the necessity** to develop a new theoretical model for a stressed nanoheterostructure with qds and to consider a renormalization of the qd energy spectrum under the influence of the self-consistent electron-deformation interaction [37, p. 1098].

Transpositions, mostly noun-to-verb ones, were used in conformity with the norms of the English language that has predominantly verbal style of expression:

27. Відзначимо тут, що **для інтерпретації** отриманих результатів ми використовуємо поняття водневих зв'язків *[30, с. 142]. – Note that we use the concept of hydrogen bonds here* ***to interpret*** *the results obtained* [29, p. 144].

Transposed were also other parts of speech, e.g. nouns into adjectives (Fragment 28), to avoid using the "of-of" structure:

28. Також не змінюється і довжина водневих зв'язків між молекулами води, про що свідчить **незмінність** положень першого та другого максимумів *[28, с. 424]. – The length of the hydrogen bonds between water molecules also is not changed, which is evidenced by the* ***invariable*** *positions of the first and second maxima* [27, p. 424].

To preserve the emphasis expressed in the source sentence, the translator used inversion as an optimal solution:

29. *Фактично,* ***основне значення*** *для нас матиме тільки середня кількість молекул води, що входить до кластерів, і та обставина, що утворення кластерів призводить до деякого зменшення об'єму розчину [30, с. 142]. – In effect,* ***of principal importance*** *are only the average number of water molecules entering the clusters and a circumstance that the formation of clusters leads to a certain decrease in the solution volume* [29, p. 144].

However, along with successful translation solutions, there are fragments with incomplete or partial equivalence. In our view, they need corrections, mostly grammatical.

One of the major translation drawbacks was placing the sentence predicate far from the sentence subject, whereas one of the manuscript language norms recommends using subject and verb as close as possible:

30. **Розглянуто** можливість фазового переходу електронів магнітосфери Юпітера в режим циклотронного надвипромінювання поблизу основи струмової трубки Іо *[36, с. 739]. – A possibility of the electron phase transition into cyclotron superradiance mode in a vicinity of the Io flux tube foot in the Jovian magnetosphere* ***has been considered*** [35, p. 740].

The translation could be corrected by using the formal subject "there" ("There has been considered a possibility...") or the agential subject ("The research considers a possibility…").

There are also long sentences that need splitting, in conformity with the scientific English norms:

31. *Такий підхід є дискусійним [2], оскільки наявність поверхні поділу привносить не тільки кількісну, а й якісну зміну різних характеристик електронної системи (наприклад, виникають сили зображення тощо), що принципово не можна врахувати в теорії функціонала густини [34, с. 1108]. – This approach is debatable [2], because the interface introduces not only quantitative, but also qualitative changes in various parameters of the electron system (e.g., the image forces emerge and so on), which cannot be taken into account in principle by the density functional theory* [33, p. 1107].

Fragment 32 also contains a syntactic inadequacy:

32. *Вважатимемо, що іонна підсистема формує поверхневий потенціал для електронів,* ***який не дозволяє їм покинути метал*** *[34, с. 1109]. –* ***Let the ionic subsystem form a surface potential for electrons in the metal,*** *which does not allow them to escape* [33, p. 1108].

In our view, this sentence has a defining clause, as it gives essential, but not extra, information. Therefore, the relative pronoun *that* should replace *which,* and no comma should be used – "**Let the ionic subsystem form a surface potential for electrons in the metal that does not allow them to escape"**.

Some other grammar corrections concern the use of tenses. In Fragment 33, Present Perfect should be used instead of Present Simple to indicate the action that started in the past and continues in the present:

33. ***Ефективна взаємодія*** *між зарядженими частинками в просторово обмежених системах* ***віддавна притягувала*** *увагу дослідників [34, с. 1108]. – The effective interaction* ***between charged particles in spatially confined systems*** *attracts* ***the attention of researchers for a long time*** [33, p. 1107].

Another grammar inaccuracy is the lack of a noun that the gerund *using* can be referred to:

34. *За допомогою подібних наближень у роботі* [11] *розраховано обернену діелектричну функцію напівобмеженого металу та ефективний потенціал [34, с. 1108]. – Using* ***similar approximations, the dielectric function of a semiinfinite metal and the effective potential were calculated in work*** **[11]** [33, p. 1107].

A possible solution here could be the following syntactic change – "**Similar approximations were used in work [11] to calculate the dielectric function of a semi-infinite metal and the effective potential".**

There are also some minor mistranslations. For example, in our opinion, the definite article, in its specifying function, should be used before the noun phrase "planet's ionosphere", as this planet – Jupiter – was mentioned in the text before:

35. При взаємодії цих потоків з іоносферою планети утворюються висхідні пучки, імовірно як наслідок утворення подвійних електричних шарів у замагніченій плазмі магнітосфери *[36, с. 740]. – When those fluxes interact with* ***planet's ionosphere****, there arise upward electron beams, probably as a result of the formation of double electric layers in the magnetized plasma of the Jovian magnetosphere* [35, p. 741].

The definite article is evidently omitted in the following sentence. It should have been used before a singular countable noun *size* ("of a methanol molecule"). But it is rather a slight than a serious translation mistake:

36. *Це природно пояснюється тим, що розмір молекули метанолу є помітно меншим, ніж розмір молекули етанолу, тому*

в околі молекули метанолу її електричне поле впливає на впорядкування оточення більш сильно [30, с. 146]. – It is so because ***size*** *of a methanol molecule is considerably smaller than the size of an ethanol molecule* [29, p. 148].

There are also cases of inexact translation. In Fragment 37, a more faithful variant is "the majority of integrals" instead of "a lot of integrals":

37. ***Більшість*** *інтегралів можуть бути обчислені в аналітичному вигляді, інтеграли, що мають полюси на дійсній осі, обчислюються у сенсі головного значення [32, с. 1090]. –* **A lot of integrals** can be calculated analytically. The integrals with poles on the real axis are calculated in the principal value sense [31, p. 1089].

Fragment 38 is an example of word redundancy, which could be avoided by using a shorter phrase *Note that*:

38. ***Звернемо увагу на те, що*** *врахування обмеженості фононного спектра граничним значенням хвильового вектору приводить до складніших виразів [32, с. 1091]. –* **It is worth paying attention to the fact that** the account for the phonon spectrum confinement by a threshold value of the wave vector results in more cumbersome expressions [31, p. 1090].

In Fragment 39, it would be better not to separate the parts of the predicate and use the phrase "reduce to zero*"* instead:

39. *Ці величини фактично* ***звужують*** *область застосовності сильного зв'язку* ***до нуля****, бо в реальних кристалах повинен здійснюватися слабкий або проміжний зв'язок [32, с. 1093]. –* Those values **reduce**, in effect, the applicability region of the strong coupling approximation **to zero**, because either the weak or intermediate coupling should be realized in real crystals [31, p. 1092].

Conclusions. Our analysis has shown that, in most cases, the choice of translation solutions was justified. In general, the translator reached his main goal – to render adequately the content of the scientific article, in keeping with the norms of the manuscript language. Our findings prove that absolute equivalence is quite hard to achieve in translating science texts. We mostly observed optimum, near-optimum and partial translation, with rare cases of mistranslation. The translated texts demonstrate plenty of attractive translation solutions that serve the purpose of achieving maximum possible text

equivalence and they could be added to one's translation armoury. The articles were rendered into English by a highly-skilled translator, who has a good command of English vocabulary and grammar and who is well trained in physics. However, the comparative analysis showed that there are some mistranslations, which need corrections due to semantic and formal losses. In general, the translations produced identical impact on the source and target text readers and demonstrated high pragmatic equivalence. The minor translation drawbacks did not have considerable effect on the meaning of the translated articles.

Thus, our research proves that it is essential for translators to be knowledgeable about the basic rules of transition from the source to the target language, in rendering science texts. To take a rational translation solution, the translator should be competent in using lexical and grammatical translation transformations and bring the source text into accordance with the norms of the language of science. The translator should be trained enough in the branch of knowledge the translation texts belong to, as the most important factors for delivering high quality scientific translations are experience, expertise and continuous updating.

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НОРМИ МОВНОГО ОФОРМЛЕННЯ НАУКОВИХ ТЕКСТІВ У ПЕРЕКЛАДІ СТАТЕЙ З УКРАЇНСЬКОЇ НА АНГЛІЙСЬКУ

Присвячено особливостям мовного оформлення наукового тексту, перекладеного на іноземну мову, на прикладі наукової статті, із метою дослідження перекладацьких рішень для досягнення прагматичної еквівалентності текстів оригіналу та перекладу. Особливу увагу приділено відповідності тексту перекладу нормам англійського наукового мовлення.

Ключові слова: наукова стаття, характерні риси наукового мовлення, норми мовного оформлення академічних текстів, ступінь перекладацької еквівалентності, українська мова, англійська мова, перекладацьке рішення, перекладацький прийом.

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