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**RELEVANCE THEORY IN SCIENTIFIC TRANSLATION:
OPTIMIZING SPECIALIZED TERMINOLOGY THROUGH
COGNITIVE-PRAGMATIC ANALYSIS**

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Abstract. Scientific translation is a complex process requiring accuracy and considering the cognitive-pragmatic aspects of perception. Challenge in special term translation is polysemy of specialized terms with conceptual variety which might be interpreted differently depending on a language of translation. Incorrect term selection can lead to misunderstandings and loss of scientific accuracy.

The aim of the study to examine application of Relevance Theory in translation of specialized terminology and adaptation of scientific discourse considering cognitive and pragmatic factors. The focus is done to investigate strategies of optimal relevance, contextual assumptions, and procedural meanings of terms. Methodology includes usage of cognitive-pragmatic, corpora, and comparison analysis of special terms, such as “shear stress”, “simple shear”, “body force” and “earthquake waves” using mechanic manuals.

Findings of the research demonstrate that term choice depends on cognitive level of target audience’ perception and on the aim of translation. Usage of Relevance Theory assists in maximizing translation accuracy and its perception providing a balance between scientific reliability and cognitive availability. The analysis confirms that adaptation of scientific discourse according to peculiarities of audience’s perception level (professionals, students, public at large) promotes more effective transfer of scientific information.

The research contributes to develop a methodological framework for training translators, creating terminological resources, and improving translation strategies in the scientific and technical sphere. The practical significance of the work is to improve the quality of scientific translation and the possibility of its application in educational, linguistic, and engineering contexts.

Keywords: Relevance Theory, scientific translation, specialized terminology, cognitive-pragmatic analysis, contextual adaptation, corpus-based analysis, terminology optimization, scientific discourse

Introduction

The translation of scientific and technical texts is a challenging process requiring not only accuracy but consider the perception differences of each audience. The main problem is to translate special terms which people supposed

to be easiest part as there are linguistic equivalents and calque translation however some terms may be concepts, homonyms or polysemantic terms. In such case the choice of correct variation is challenging, and usage of incorrect variant brings to misunderstanding or distortion of meaning and scientific precision. Also, important consideration is cognitive level of audience and their background knowledge which effect on perception rate.

Relevance Theory of translation proposed by Dan Sperber and Deirdre Wilson, uses a cognitive-pragmatic approach aimed to achieve maximum cognitive efficiency using minimal efforts. This is achieved by a message interpretation where the meaning of term is determined by contextual perception, not by lexical semantics.

In the article we analyze the usage of Relevance Theory in translation of special terms and their adaptation in scientific discourse considering cognitive strategies of information perception.

The aim of the research is to apply Relevance Theory to translate special terms and to adapt scientific discourse considering cognitive and pragmatic features of information perception. The tasks of the work are:

1. To describe main peculiarities of Relevance Theory and their impact on translation.
2. To analyze specifics of special term translation in scientific discourse.
3. To consider the role of contextual assumptions and cognitive mechanisms in interpreting terminology.
4. To compare different methods for translating special terms (literal translation, adapted translation, pragmatic translation).
5. To demonstrate the importance of adapting scientific discourse for different audiences.

The novelty of research is to use Relevance Theory in translating special terminology, especially in mechanics and engineering domains, where terms are mostly polysemantic, conceptual variative or procedural meaningful. This research is focused on investigating cognitive-pragmatic strategies which assist to optimize choice and adaptability of terms. This approach is contrast to traditional approaches when direct translation methods are used (calque or word-by-word translation).

This research does not purely focus on comparative linguistic analysis, it is more aimed to study Relevance Theory's principles directed to optimal relevance, contextual assumptions, and procedural meaning influence on translator's decisions. The work determines the best suitable choice of translation of the term minimizing cognitive perception efforts of the target audience using the term equivalents based on corpora analysis and expert consultations.

Literature review

Relevance Theory of translation proposed by Dan Sperber and Deirdre Wilson in 1986, perceives communication as a process in which each part tries to achieve maximum cognitive efficiency using minimum efforts [1]. This principle

is important in translation process, especially in scientific or technical translation where term translation is crucial.

The researchers note that traditional (semantic, syntactical) approaches to terms' translation might be insufficient as they are blind to cognitive and pragmatic factors of information perception [2,3]. Cognitive-pragmatic analysis considers mental models of audience and use term's equivalence in accordance with that audience. It means to use direct equivalent for professional audience and use adaptation (add description or determinators) for not professional one.

Relevance Theory proposes three main methods of translation:

1. Optimal relevance when we choose equivalent which is understandable for a target audience, e. g. to use “касательное напряжение” (shear stress) instead of “напряжение сдвига” for Russian-language mechanical texts [4, p. 178-182].
2. Contextual assumption is a strategy which considers background knowledge of a target audience. This strategy is useful when we need to translate terms with high degree of polysemy [4, p. 28-35].
3. Procedural meaning is a strategy when a term may encode either conceptual or procedural information, which influences its interpretation [4, p. 85-108].

The usage of these methods in scientific translation assists to more precise and accurate transference of meaning that is proved by empirical evidence [5, 6]. The effectiveness of cognitive-pragmatic strategies in translation highlights the following advantages:

1. Relevance Theory allows translators to consider the cognitive processes of readers and adapt terminology depending on the communicative context.
2. Corpus analysis and cognitive mapping techniques reduce errors associated with homonymy and polysemy, ensuring greater consistency in terminology usage.
3. Integrating cognitive-pragmatic analysis into translator training programs can significantly increase translation accuracy, especially in scientific and technical fields.

However, it is important always remember that terminology studies content and essence of terms in linguistics. Thus, linguistic research, such as the study of metaphors in terms formation, play an important role in the development of terminology. Terms formation, as any generally used words, is based on national cognitive mechanisms and metaphor is important cognitive element in terms formation. As the research denotes [7, p. 322-343] metaphors are used as in speech, so they form the way of thinking and information perception mechanisms as well as play role in creating concepts.

Furthermore, A.K. Zhumabekova analyzed the methods of special linguistic term translation from English into Kazakh and identified the main problems associated with terminological gaps and inconsistencies in national terminological systems. The study considered both direct and indirect translation

methods, including transliteration, calques, and selection of equivalents. It was found that incorrect use of the terminological base, e.g. borrowing terms through the Russian language, can lead to factual errors and a violation of the terminology systematicity [8, p. 1477–1493].

While Ch. Nord mentions three fundamental challenges in scientific translation that further support the necessity of a cognitive-pragmatic framework:

1. Linguistic difficulties include terminological variability and polysemy, which require precise selection of equivalents.

2. Conventional differences mean the specificity of the use of terms in different languages, often necessitating adaptation.

3. Pragmatic aspects refer to adaptation of the text for the target audience's cognitive and cultural expectations [9].

These factors reinforce the need for an integrated approach that incorporates Relevance Theory and cognitive-pragmatic analysis to ensure translation precision, coherence, and accessibility. The combination of corpus-based linguistic research, cognitive mapping, and relevance-driven adaptation strategies provides foundation for optimization of scientific results.

Thus, further development in this area seems promising from both theoretical and practical points of view as for translators, linguists, and scholars who engage in cross-disciplinary studies.

Materials and methods

Material for study is texts of manuals written in the English language and their possible translation in Russian language. Methods of research are cognitive and pragmatic analysis as well as corpus-based and comparison analysis. Cognitive analysis is used to investigate how different linguistic systems code interpret special terms on the base of the reader's cognitive load and background knowledge while pragmatic analysis studies the role of context and discourse norms in terms' translation choice. Corpus-based analysis estimates dominant term equivalence in special texts to ensure consistency with established scientific discourse. Comparative analysis assists in differentiation terms' usage in languages highlighting key challenges in multilingual scientific translation.

The object of research is special translation of terms and their adaptation in scientific discourse while the subject of research is application of Relevance Theory in terms translation and influence of cognitive-pragmatic factors on translation strategy selection.

Thus, this study determines optimal methods of translation special terms by balancing semantic fidelity, cognitive accessibility, and discourse adaptation. The results show that Relevance Theory increases the term accuracy and precision by allowing translators to use as direct equivalents, so contextual adaptations and procedural interpretations, thereby this methodology improves both readability and scientific accuracy.

Discussion and results

The theoretical insights highlight the significance of Relevance Theory and cognitive-pragmatic analysis in scientific translation. We examine specific translation methods applied to specialized terminology to explore practical application of cognitive-pragmatic analysis based on Relevance Theory. The analysis focuses on the concept of “shear” in the field of continuum mechanics. By applying the principles of optimal relevance, contextual assumptions, and procedural meaning, we evaluate how translation choices can be optimized for accuracy, accessibility, and cognitive efficiency.

The example taken from the manual “Introduction to Continuum mechanics” by Panayiotis Papadopoulos has several terminological units which might be translated incorrect using direct translation type.

“... simple shear. Consider the case of simple tension along ...-axis, ... while all other components of the stress are zero. This is clearly an equilibrium state in the absence of body force. It follows ... that in an isotropic linearly elastic solid ...while all shearing components of strain vanish” [10, p. 235-236].

We use ellipsis to omit equations and unnecessary symbols which are important for specialists of mechanics but has minor semantic for linguistic specialists. The abstract contains terminological combination “simple shear” which may be translated as “элементарный сдвиг” or “простой сдвиг” in Russian language. As there are two options for translation it is necessary to make corpora analysis to choose the most appropriate variant. We use Russian language national corpora and find out that there is no terminological combination “элементарный сдвиг”, when we check the combination “простой сдвиг” we have evidence of such usage in scientific discourse (see Figure 1). Relevant Theory let to choose the most suitable equivalent and minimize cognitive efforts of target audience’ perception which means that this variant is used in scientific-popular discourse. That fact gives the evidence to relevance of this equivalent usage.

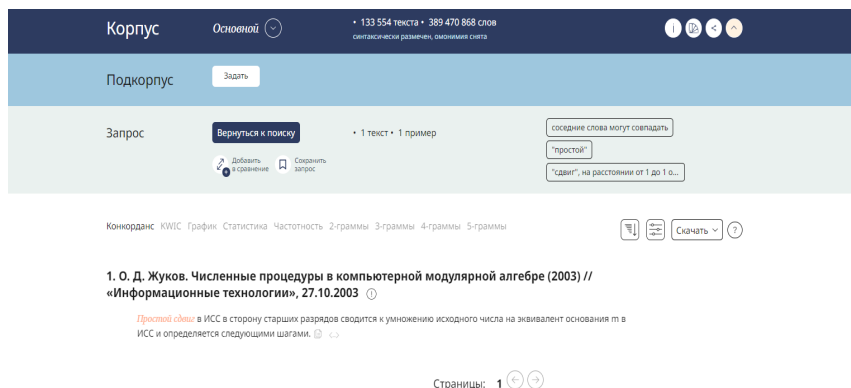


Figure 1 – Results of Corpora analysis

In the same sentence there is a terminological combination “body force” which can be translated as “силы тела” and “объемные силы”. However, we are informed that in Russian mechanical manuals the terminological combination “объемные силы” is used. This contextual knowledge assists avoid calquing and choose suitable equivalence to the scientific discourse.

The combination “shear stress” as well can be translated as “напряжение сдвига” and “касательное напряжение”. In this case the equivalent depends on the purpose of translation:

- it is aimed to professionals then it is better to use “касательное напряжение”.

- it is aimed to students or people who have not sophisticated background knowledge, then to use “напряжение сдвига” is possible or it is better to use descriptive translation as “сила, действующая на единицу площади параллельно поверхности”.

Thus, the translation of scientific terms requires consideration their procedural meaning, i. e. what cognitive operation translator wants to activate in the target audience.

When we work with a text, we need to understand to whom the text is being translated. Depending on a target audience, the different methods are used. For example, if the text is for professionals, then the terminology is accurate and defined by terminological system. If the text for students or a public at large, then the terminology should be accomplished by descriptions or interpretational notes.

“Pure shear with shear stress τ relative to the direction pair (k, a) , where k and n are orthogonal unit vectors: ...” [11, p. 106]

In this case we need to understand for what audience we prepare the translation. If it is for specialists then we use contextually adapted translation: “Чистый сдвиг с касательным напряжением τ относительно пары ортогональных направлений (k, a) . Здесь k и n – единичные векторы, определяющие направление действия касательных напряжений”. If it is for students or public at large we need to use interpretation tools: “При чистом сдвиге параллельные плоскости тела смещаются относительно друг друга без изменения формы и объема. Это явление используется в теории упругости для анализа напряженно-деформированного состояния материалов. Здесь « k » и « n » являются обозначениями для единичных векторов, определяющих направление действия касательных напряжений”.

If we translate terms using Relevance Theory, we need to make several steps:

Step 1: Identifying the Term Type

- A term might be lexically unambiguous term. In this situation usage of direct translation type is preferable, e. g. literal translation or calque (shear modulus → модуль сдвига).

- A term might be homonyms or polysemous term. In this case contextual equivalent is usually used (e.g., shear stress → касательное напряжение or напряжение сдвига).

- A term might refer to conceptual or procedural term. In this case cognitive-driven interpretation is preferable variation for translation (e.g., body force → объемные силы).

Step 2: Considering the Target Audience

- If the translation is for specialists, then we need be directed by terminological accuracy and fidelity, which means that we need to find direct scientific equivalent.

- If the translation is for students, we may use cognitive accessibility. This means to use additional explanation or paraphrased definitions.

- If the translation is for general audience, then we may use discourse adaptation tools which contain conceptual rather than terminological translation.

Step 3: Corpus-Based Validation and Expert Preference

Corpora analysis finds out preferred term usage in scientific texts, it helps to use in translation. Corpora search assists in analyzing dominant term usage, then we apply in translation only standardized translation (e.g., simple shear → простой сдвиг). In a case when we do not have corpus evidence, then we might rely on translator discretion based on discourse norms.

Also, very powerful tool is expert consultation and awareness of terminology norms which assists to use only established terms of a particular discourse, in our case engineering and mechanical one.

Step 4: Relevance-Theory Based Decision

The decision-making process in translating refers to usage of several strategies which assist in choosing the most appropriate equivalent for definite context. These strategies include:

- the first strategy is optimal relevance which directed to select term ensuring minimal cognitive effort (e.g., commonly used equivalent).

- the second strategy is contextual assumptions, which considers the knowledge level of reader (a target audience).

- the third is procedural meaning which ensures the term activates the correct cognitive process in reader's mind [4]. Thus, sometimes, cognitive process connects metaphorical source of term formation. In this case translator needs to understand the nature of metaphor and the concept lies, e. g. the term "earthquake waves" has a metaphorical background drawing an analogy between the propagation of seismic energy through the Earth and the way waves travel across the surface of water. So, in formulating some concept which lately becomes a term, a metaphorical transfer is applied. This tool assists in explanation complex concept by simplification using similarity. Thus, here there are similarities in the motion of waves: crests, troughs, wavelength, frequency, etc. So, the metaphor of a "wave" simplifies a complex phenomenon, making it more intuitive. As all people are familiar with the concept of waves on water, so it is easier for them to imagine how the energy from an earthquake "moves" through the earth. In translation the same concept was used "волны землетрясения" / "жерсілкіну (жер сілкінісі / жер сілкіну) толқындары". According to Terminkom.kz there are several possible terms depending to scientific area, so term "жерсілкіну"

relates to geology, term “жер сілкінісі” – to mechanics while “жер сілкіну” – to physics. As even if this natural phenomenon is an object for research by different domains it is correct to use physical equivalent in term formation, thus “жер сілкіну толқындары” is a correct variation which preserves metaphorical origin of the concept and explains physical processes.

Thus, the results of terms’ analysis made above can be summarized in Table 1.

Table 1. Relevance Theory’s methods in special term translation

Source Term	Possible Translations	Translation Type	Final Choice (Based on Corpus and Audience)
Simple shear	элементарный сдвиг / простой сдвиг	Corpus-based	Простой сдвиг
Body force	силы тела / объемные силы	Contextual adaptation (equivalent)	Объемные силы
Shear stress	напряжение сдвига / касательное напряжение	Procedural meaning	Касательное напряжение (for specialists) / Напряжение сдвига (for students)
Earthquake waves	жер сілкіну толқындары / жер сілкінісі толқындары / жер сілкіну толқындары	Metaphorical transfer + Contextual adaptation	Жерсілкіну толқындары (physical term preserves metaphor and explains physical processes)

The table was designed based on the results of the research.

Conclusion

The research solves key problems including analysis of Relevance Theory influence on translation estimating the role of contextual assumptions and cognitive mechanisms in terms interpretations and in comparing different translation methods such as literal, adaptive, and pragmatic translation.

The results approve that Relevance Theory supports effective framework for translating special terminology as theory considers cognitive processes of target audience and guarantees translated terms be accurate and accessible for perception. The study demonstrates that:

- Optimal relevance assist translators to choose equivalents which suit cognitive expectations of the target audience ensuring minimal processing efforts of audience.

- Contextual assumptions are crucial in choosing terms which rely to background knowledge and professional domain of reader assisting to avoid misunderstanding.

- Procedural meaning affects how terms are understood in discourse highlighting the necessity of taking into consideration cognitive operations that term may activate in the target audience’s brains.

Translators can optimize transference of the meaning at the same time preserving scientific accuracy by applying cognitive-pragmatic strategies.

Comparative analysis of terminology choice based on corpus-based checking demonstrates the relevance-based approach significantly increases translation accuracy and coherence of special texts.

Thus, this research underlines the importance of Relevance Theory in scientific translation proving that it provides effectiveness of adaptational tools in scientific discourse translation for each target audience by refining terminological selection. Future studies may be directed to additional research in the field of integrating Relevance theory with scientific translation through machine-assisted translation models or in the direction of standardization multilinguistic terminological systems.

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ҒЫЛЫМИ АУДАРМАДАҒЫ ӨЗЕКТІЛІК ТЕОРИЯСЫ: КОГНИТИВТІК-ПРАГМАТИКАЛЫҚ ТАЛДАУ АРҚЫЛЫ АРНАЙЫ ТЕРМИНОЛОГИЯНЫ ОҢТАЙЛАНДЫРУ

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Алматы, Қазақстан

Аңдатпа. Ғылыми мәтіндерді аудару – дәлдікті ғана емес, сонымен қатар мақсатты аудиторияның ақпаратты қабылдауының когнитивтік және прагматикалық ерекшеліктерін ескеруді талап ететін күрделі процесс. Негізгі мәселелердің бірі – арнайы терминологияны, әсіресе полисемантикалық мағынасы мен концептуалды өзгермелілігі бар терминдерді аудару тілі мен қолданылу контекстіне байланысты әртүрлі түсіндіріледі.

Бұл зерттеудің мақсаты ғылыми терминологияны аударуда релевант теория тұжырымдамасын қолдануды, сондай-ақ когнитивтік және прагматикалық факторларды ескере отырып, ғылыми дискурсты бейімдеуді талдау болып табылады. Жұмыстың негізгі бағыттары оңтайлы сәйкестік стратегияларын, контекстік болжамдарды және терминдердің процедуралық мағынасын зерттеуді қамтиды. Әдістеме механика оқу құралыларындағы негізінде «shear stress» (ығысу кернеуі), «simple shear» (жай ығысу), «body force» (дене күші) және «earthquake waves» (жер сілкінісі толқындары) терминдерін мысалға ала отырып, когнитивтік-прагматикалық, корпустық және салыстырмалы талдауды қамтидық.

Зерттеу нәтижелерінің бірі, термин таңдау аудиторияның танымдық деңгейіне және аударма мақсатына байланысты екенін көрсетеді. Екіншісі, релевант теорияны пайдалану ғылыми сенімділік пен танымдық қолжетімділік арасындағы тепе-теңдікті қамтамасыз ете отырып, аударманың дәлдігі мен оқылуын жақсартуға көмектеседі. Үшіншісі, талдау ғылыми дискурсты әртүрлі аудиториялардың (мамандар, студенттер, жалпы адамдарға) қабылдау ерекшеліктеріне бейімдеу ғылыми ақпаратты тиімдірек жеткізуге ықпал ететінін растайды.

Зерттеудің үлесі аудармашыларды даярлаудың әдістемелік базасын әзірлеу, терминологиялық ресурстарды құру және ғылыми-техникалық саладағы аударма стратегияларын жетілдіру болуы мүмкін. Жұмыстың практикалық маңыздылығы ғылыми аударманың сапасын арттыруда және оны оқу, лингвистикалық және инженерлік контексттерде қолдану мүмкіндігінен көрінеді.

Тірек сөздер: релевант теориясы, ғылыми аударма, арнайы терминология, когнитивтік-прагматикалық тәсіл, контекстік бейімделу, корпусдық талдау, терминологияны оңтайландыру, ғылыми дискурс

**РЕЛЕВАНТНАЯ ТЕОРИЯ В НАУЧНОМ ПЕРЕВОДЕ:
ОПТИМИЗАЦИЯ СПЕЦИАЛИЗИРОВАННОЙ ТЕРМИНОЛОГИИ
ЧЕРЕЗ КОГНИТИВНО-ПРАГМАТИЧЕСКИЙ АНАЛИЗ**

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Аннотация. Перевод научных текстов является сложным процессом, требующим не только точности, но и учета когнитивно-прагматических особенностей восприятия информации целевой аудиторией. Одной из основных проблем является перевод специализированной терминологии, в особенности терминов с полисемантическим значением и концептуальной вариативностью, которые могут интерпретироваться по-разному в зависимости от языка и контекста использования.

Целью данного исследования является анализ применения концепции релевантной теории в переводе научной терминологии, а также адаптации научного дискурса с учетом когнитивных и прагматических факторов. Основные направления работы включают в себя изучение стратегий оптимальной релевантности, контекстуальных допущений и процедурного значения терминов. Методология включает когнитивно-прагматический, корпусный и сравнительный анализ терминов, на примере терминов «shear stress», «simple shear», «body force» и «earthquake waves» на материале учебников по механике.

Результаты исследования демонстрируют тот факт, что выбор термина зависит от когнитивного уровня аудитории и цели перевода. Применение релевантной теории помогает повысить точность и воспринимаемость перевода, обеспечивая баланс между научной достоверностью и когнитивной доступностью. Анализ подтверждает, что адаптация научного дискурса в соответствии с особенностями восприятия различных аудиторий (специалистов, студентов, широкой публики) способствует более эффективной передаче научной информации.

Вклад исследования может заключаться в разработке методологической базы для подготовки переводчиков, создании терминологических ресурсов и совершенствовании переводческих стратегий в научно-технической сфере. Практическая значимость работы проявляется в повышении качества научного перевода и возможности его применения в образовательных, лингвистических и инженерных контекстах.

Ключевые слова: релевантная теория, научный перевод,

специализированная терминология, когнитивно-прагматический подход, контекстуальная адаптация, корпусный анализ, оптимизация терминологии, научный дискурс

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