



Linguistic-cognitive modelling of IT-terms in translation: Frame-based approach

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Abstract. The research relevance is determined by rapid development of information technologies and need for adequate translation of highly dynamic English information technology terminology into Ukrainian, which requires transitioning outside of formal lexical correspondence to ensure cognitive equivalence. The study aimed to conduct a comprehensive investigation of potential of frame analysis as a tool for linguistic-cognitive modelling in translation of information technology terminology. Reliability of results obtained was ensured by use of general scientific and linguistic methods: descriptive method, contextual-interpretative analysis, frame-based modelling, contrastive analysis, and corpus linguistics approaches. Based on an analysis of a bilingual parallel corpus extracted from official documentation of Blender software, relevant features of technical texts were interpreted, and frame structures of selected terms from domains of 3D modelling and animation were reconstructed and compared. The main focus of the study was assessment of cognitive equivalence and identification of implicit conceptual discrepancies between source and target languages. The study established that established information technology vocabulary, particularly within geometric, temporal, and interface-related domains, demonstrates a high level of frame correspondence and structural stability in target language. Conversely, translation of innovative, multi-component, and procedurally oriented terms frequently results in significant cognitive asymmetries. Frame shifts were disclosed primarily in loss of procedural characteristics, alteration of functional syntax through passive verb constructions, and unjustified transference of digital instrument concepts into tangible physical domains. Fundamental criteria for preservation of conceptual integrity of multiword terms by accurately synthesising constituent frame slots were established. Practical significance of the study conducted was primarily by the possible use of results

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in systematisation and refinement of approaches to domain-specific lexicography, improvement of professional training of technical translators, and integration of structured conceptual networks into neural machine translation systems

Keywords: cognitive equivalence; conceptual mapping; 3D modelling nomenclature; domain-specific vocabulary; procedural semantics

Introduction

Continuous development of information technologies (IT), digitalisation of a range of spheres of industry, and globalisation of professional communication drive further formation and updating of IT terminology. English is a predominant language of origin of innovative terms, rapidly disseminating in international scientific and technical discourse, thus necessitating adequate reproduction in other languages, including Ukrainian. Under the aforementioned conditions, translation of IT terminology exceeds the scope of lexical correspondence, thus transforming into a complex cognitive process associated with transfer of specialised knowledge, procedures, and conceptual methods. However, use of general or formally similar equivalents often causes semantic simplifications, frame shifts, or loss of functional and procedural characteristics of a highly dynamic vocabulary.

Contemporary terminological and translation studies emphasise that adequate translation should reproduce underlying structure of conceptual knowledge embedded in a term rather than be limited to dictionary equivalents. To address such cognitive asymmetries, frame analysis has been proposed as a fundamental part of translation process. According to J.F. Nwachukwu (2024), methodological frameworks integrate frames into every stage of translation of pragmatic texts, moving translation into a conceptual plane of the text and supporting consistent decision-making strategies. Pre-translation frame modelling can be used to demonstrate knowledge and structure concepts before actual linguistic transfer

occurs. As established by O. Czulo *et al.* (2019), assessment of semantic similarity outside the scope of forms is facilitated by frame semantic evaluation models. The researchers emphasised that such models compare source and target language at frame levels to ensure cognitive equivalence, which is crucial for modern evaluation. Preservation of such frame structures is a critical criterion for successful translation, as formal correspondence omitting cognitive roles often provides partial or complete loss of meaning.

Theoretical foundation of frame analysis extends outside the scope of structural linguistics, functioning as a critical framework for discourse analysis and cognitive modelling. Following H. Rishniak (2021), frames operate as complex social and cognitive structures that organise knowledge and govern interpretation of specialised texts. The study further demonstrated that these cognitive structures are essential for aligning source language intent with target reader's comprehension. According to T.A. Van Dijk (2023), frame analysis is critical for analysis of meaning construction and formation within specific communicative contexts, including professional and technical discourses. The study highlighted how contextual framing directly dictates the pragmatic interpretation of specialised terminology. Such cognitive organisation is further supported by N. Hinrichs *et al.* (2022), suggesting that human comprehension of complex, abstract systems relies on fundamental physical and spatial frames. The authors concluded that embodied metarepresentations serve as the primary

cognitive bridge for understanding intangible digital concepts. Furthermore, S. Vicari (2023) also concluded, that in specialised communication, frame semantics can be used to study how collective action in specialised communication, frame semantics can be used to study how collective action and procedural sequences are linguistically encoded. As argued by H. Hamamoto (2023), the translation of such structures requires the transformation of culturally or domain-specific concepts to provide proper translation equivalence in the target language. The researcher highlighted that failing to adapt these conceptual frames inevitably leads to pragmatic failure in cross-lingual communication. Following M.I. Sevastiuk (2023) cognitive modelling of discourse demonstrates that frames are heavily utilised to render specific strategies and functional roles. Consequently, the study confirmed that isolated term translation is fundamentally inadequate for highly contextualised communication.

Application of frames to specialised vocabulary is primarily implemented through the Frame-Based Terminology (FBT) approach. Researchers P. Faber & M. Cabezas-García (2019) established that this approach models specialised knowledge from individual terms to complex conceptual frames. Their findings revealed underlying conceptual structures that translators must transfer to ensure technical accuracy. Although highly dynamic IT domain remains underexplored from this perspective, D. Hitcheva (2025) demonstrated that the translation of specialised domains with similar properties, such as building materials or transport logistics, can be successfully analysed using frame-based terminology. The author's research validated the use of cognitive methods to address highly specific translation problems across various applied fields. According to R. Resi (2024), frame-based methods can be used to detect and address terminological gaps between languages. The researcher noted that identifying these conceptual mismatches

serves as a reliable guide for formulating effective translation strategies for challenging terms. Lastly, T. Maslova & S. Fedorenko (2022) concluded that this methodology is particularly well-suited for the analysis of specialised units in multidisciplinary texts. They highlighted its utility in the creation of conceptual networks of events, processes, and objects, which perfectly correlates with the highly procedural nature of IT discourse.

Consequently, absence of theoretically grounded cognitive models forces translators to rely on intuitive or non-standardised solutions, increasing risk of terminological variability and cognitive inconsistency. By building IT-specific frames that correlate roles, processes, and tools, it becomes possible to analyse both terminology and cognitive equivalence of translation. The study aimed to substantiate the potential of frame analysis as a tool for linguistic-cognitive modelling in the translation of IT terminology.

Materials and Methods

The empirical material for this study incorporated a selected sample of sentences extracted from official bilingual documentation of Blender software (Blender Translate, n.d.). This specific source was selected due to a substantial concentration of innovative, highly dynamic IT terminology related to 3D modelling, computer graphics, and animation. Terminology within this specialised domain is frequently multi-component and strictly associated with specific digital instruments and procedural actions, which necessitates an in-depth cognitive approach to translation. Selected English-Ukrainian dataset is an optimal foundation for evaluation of cognitive equivalence of translation decisions, as standard lexicographic resources often fail to capture complex functional characteristics inherent in such domain-specific vocabulary.

To facilitate a systematic analysis, the research data was initially compiled into a local

bilingual parallel corpus. The text extraction procedure involved conversion of “.po” (Portable Object) software localisation files into a structured bilingual format using. Following extraction, raw linguistic data was subjected to a cleaning process to eliminate non-linguistic technical artefacts, including markup tags, formatting syntax, and HTTP links, thereby ensuring a corpus of plain text. Sentence-level alignment of the English source texts and their corresponding Ukrainian translations was subsequently performed utilising the NOVA Text Aligner software. Identification and selection of specific terms for the frame analysis were conducted through a comparative filtering process using VESUM platform (the Large Electronic Dictionary of Ukrainian). This methodological step was used to isolate highly specialised and innovative IT terms that are absent from or inadequately represented in standard general dictionaries.

Overall research methodology was based on a combination of descriptive method, contextual-interpretative analysis, frame-based modelling, and contrastive analysis. FBT framework, which was also used by P. Faber & A. Reimerink (2019), analytical procedure was conducted in sequential stages. Initially, a contextual-interpretative analysis was used to ascertain the determine conceptual meaning of selected terms within authentic technical discourse. Subsequently, frame-based modelling was applied to reconstruct cognitive structures of terms in both source and target languages. This involved creation of domain-specific frames and mapping of semantic roles of each term, such as agent, instrument, or process of modification, which included “tool function”, “structural relation”, “temporal”, “deformation”, “structural relation”, “manipulation”, “UI” frames (Sullivan, 2023).

To ensure consistency of application of this framework, cognitive mapping procedure was used for systematic decomposition of each term into constituent frame slots. A standard

procedural frame within the 3D modelling domain typically comprises a minimum of four obligatory slots: agent (user or automated system initiating the action), target (digital entity being manipulated, such as a polygon or vertex), instrument (specific algorithmic tool or interface element employed), and result (altered geometric or temporal state). Conversely, entity-based frames rely on structural slots, explicitly defining part-whole relationships, spatial orientation, and hierarchical dependencies within software architecture. By formally categorising extracted terminology into specific frame typologies prior to contrastive analysis, methodology mitigates subjective bias and establishes a verifiable matrix for further assessment of whether target language equivalent activates an identical configuration of cognitive slots. A contrastive analysis was used to compare frame structures across two languages. Comparative stage aimed to determine degree of cognitive equivalence and identify any implicit conceptual discrepancies, frame shifts, or losses of procedural characteristics resulting from translation process, as utilised in similar studies by I. Zakaria (2017) and R. Resi (2024).

Methodological validity of frame identification in bilingual texts is based on corpus linguistics approaches, which provide empirical data for analysis of framing practices across beginner level and proficient translators (Pan, 2020). Extraction of semantic frames from specialised corpora serves a dual purpose: it is used in the translation process and provides structured data for lexicographic purposes (Sánchez Cárdenas, 2024). In contemporary computational terminology, frame-based meaning representation of multiword terms requires alignment and structuring to be effective in technical digital dictionaries (Giacomini, 2018; Giacomini & Schäfer, 2020). To manage this complexity, advanced term dictionary automatic extraction algorithms, including those based on bidirectional long short-term memory (BiLSTM) neural networks, are increasingly utilised

to isolate relevant vocabulary from extensive text datasets before cognitive analysis is applied (Liu, 2025). Although the present study relies on a manually curated parallel corpus of Blender documentation, methodological principles underlying alignment and frame mapping are consistent with these computational frameworks. By adopting such corpus-based methodologies, the study ensured that identified terminological gaps and frame shifts represent systemic linguistic phenomena rather than isolated translational errors.

Results and Discussion

Application of the frame-based approach to linguistic-cognitive modelling of IT terminology translation was verified on compiled bilingual corpus. Evaluation primarily addressed semantic accuracy of translation and preservation of conceptual frame structure within

target language. The empirical sample, comprising 17 bilingual sentences extracted from official Blender documentation (Blender Translate, n.d.), encompasses a diverse spectrum of terms associated with 3D modelling, animation, and graphical manipulation instruments. Frame analysis of these specific units reveals a complex hierarchy of conceptual domains, where each term performs a highly specific role related to structure, function, or modification process of digital objects. Extracted data demonstrates both a high degree of cognitive equivalence in certain instances and notable semantic discrepancies in others, confirming that terminology functions not as isolated lexical units, but as elements of broader conceptual networks (L'Homme, 2018). The complete dataset, including the English source terms, their Ukrainian translations, and identified semantic frames, is presented below (Table 1).

Table 1. Selected sample of sentences

No.	Source and target language sentence (English-Ukrainian)	Selected term frame
1	Add an armature with a chain of bones	Tool function – structural relation, frame shift
	Додається арматура з ланцюгом кісток	
2	Skin the mesh to the armature using weight painting	Structural relation, polygonal surface, frame is equal
	Покривається сіттю арматура за допомогою малювання вагомостей	
3	Rigging often involves using one or more of the following features	Tool function – general operation, frame shift – loss of animation specifics
	Оснащення часто передбачає використання однієї чи більше з наступних функцій	
4	First, in the Timeline , or other animation editors, set the frame to 1	Temporal, frame is equal
	Спершу, на часолінії або в іншому редакторі анімації установіть кадр як 1	
5	Lattice or commonly called deformation cage outside of Blender	Deformation – structural relation, frame shift
	Решітка або зазвичай називається кліткою деформації за межами Blender	
6	Mirrors the vertices displacement from their base position	Structural relation, frame is equal
	Дзеркалить зміщення вершин відносно їх базової позиції	
7	Rate of subdivision in the axes	Geometry manipulation, frame is equal
	Частота підподілення по осях	
8	Example of an Exposure node	Light manipulation – photography, frame is partially equal
	Приклад використання вузла « Експозиція »	
9	Mesh skin weighting is used to control how much a bone deforms the mesh of a character	Deformation weight – surface, frame shift
	Виважування сітвого покриття використовується для керування тим, наскільки кістка деформує сіть персонажа	

Table 1. Continued

No.	Source and target language sentence (English-Ukrainian)	Selected term frame
10	Animating with Grease Pencil	Drawing tool, frame is equal
	Анімування за допомогою Нарисного Олівця	
11	When enabled, Blank keyframe will be created on all layers, not only the active one	Animation, frame is equal
	При увімкненні Пустий ключкадр буде створено на всіх шарах, а не лише на активному	
12	Removes any faces in current selection	Geometry, frame is equal
	Вилучає будь-які грані у поточному вибранні	
13	Each normal will be an interpolation between its original value and the direction to the target	Light geometry, frame is equal
	Кожна нормаль буде інтерполяцією між її оригінальним значенням та напрямком на ціль	
14	N-gon face having its center dot inside another face	Geometry, frame is equal
	Грань N-бічника має її центральну точку всередині іншої грані	
15	If a metaball has Negative influence the meta is not visible in the 3D Viewport, only the surrounding circles are shown	Influence, frame is equal
	Якщо метакуля має вплив Negative, то мета не є видимим у 3D Оглядвікні – 3D Viewport, показуються лише оточувальні кільця	
16	Recalculate and clear the offset transform of the hook	Deformation control – physical object, frame shift
	Перераховується та зчищається зсув трансформування гачка	
17	The Gimbal gizmo in this rotation mode shows a set of three orthogonal axes in which the Z axis goes along the defined rotation axis, i.e., it points towards the direction defined by the (X, Y, Z) point	UI manipulator, frame is equal
	Гізмо Gimbal у цьому режимі обертання показує набір трьох ортогональних осей, в якому вісь Z проходить уздовж визначеної осі обертання, тобто вона вказує у напрямку, визначеною (X, Y, Z) спрямуванням	

Source: compiled by the author based on Blender Translate (n.d.)

Based on the comparative results outlined in the table, a substantial proportion of established IT vocabulary demonstrates a full or high level of frame correspondence in Ukrainian translation. This cognitive equivalence is predominantly observed within geometric, temporal, and interface-related conceptual domains. For instance, terms such as “mesh” («сіть» [sit]), “vertices” («вершини» [vershyny]), “faces” («грані» [hrani]), and “N-gon face” («грань N-бічника» [hran N-bichnyka]) constitute the core of a structural frame, wherein an object is conceptualised as an aggregation of stable geometric components. Translation of these units strictly maintains the primary cognitive schema and structural imagery, thereby supporting absolute frame equivalence between English and Ukrainian concepts. Similarly, temporal and procedural terms, including

“Timeline” («часолінія» [chasoliniia]) and “Blank keyframe” («пустий ключкадр» [pustyi kliuchkadr]), successfully reproduce functional purpose and temporal axis without any contextual simplification. Furthermore, spatial modification parameters such as “subdivision” («підподілення» [pidpodilennia]) and “normal” («нормаль» [normal]) activate stable mathematical frames that seamlessly transfer into target language. As mentioned by I. Zakaria (2017), preservation of these systemic relations and roles within their respective frames constitutes the foundation for determination of translation success, ensuring conceptual integrity and pragmatic accuracy of technical discourse.

Outside the scope of geometric and temporal structures, analysis highlights successful translation of terms that rely on interdisciplinary conceptual borrowing and metaphorical

framing. A prominent example is term “Exposure node”, which originates from photochemical frame of traditional photography but is digitally repurposed to control light intensity algorithms in rendering. The Ukrainian translation, «вузол “Експозиція”» [vuzol “Ekspozytisia”], exhibits a partial but highly functional frame equivalence. While it retains core meaning of light manipulation, inclusion of the node concept integrates it into a programmatic, node-based workflow frame characteristic of contemporary shading environments. Similarly, term “Grease Pencil” activates a specific drawing tool frame, conceptually transferring the physical affordances of a 2D writing instrument into a 3D spatial interface. Translation «Нарисний Олівець» [narysnyi olivets] reproduces this metaphorical frame, preserving both functional role of the instrument and its intuitive conceptualisation for the user.

Furthermore, a comprehensive evaluation of cognitive equivalence is correlated with terminological verb collocations, which frequently affect specific procedural frames within technical instructions. This phenomenon is notable in Sentence 2, where the English source text uses the phrase “Skin the mesh to the armature”. In this context, “skin” functions as an active procedural verb, establishing an instrumental frame of binding digital geometry to an underlying skeletal structure. Ukrainian translation, «Покривається сіттю арматура» [pokryvaetsia sittiu armatura], introduces a shift in syntactic and cognitive framing. By transforming an active procedural command into a passive description of a state, the target language text displaces primary slot of the Agent and alters hierarchical relationship between mesh and armature. Consequently, while structural components («сіть» [sit], «арматура» [armatura]) are translated with high lexical fidelity, procedural frame of the instructional sentence is compromised, shifting user’s cognitive focus from executing a specific 3D modification technique to observation of a spatial relationship. This

demonstrates that preservation of cognitive equivalence of IT discourse requires translators to align not only isolated nouns but entire functional syntax of the operational frame.

Another notable category identified within the dataset encompasses interface manipulators and parametric influence frames. The term “Gimbal gizmo” belongs exclusively to the “User Interface (UI) manipulator” frame, where primary cognitive slots represent axes of manipulation and direct user interaction. Transliterated retention of the term as «Гіздо Gimbal» [Hizmo Gimbal] in Ukrainian sustains specific interaction frame without attempting an artificial, and potentially confusing, conceptual localisation. By retaining established internationalism, translation preserves exact UI affordances. Furthermore, term “meatball” combined with “Negative influence” activates a mathematical and spatial field-of-effect frame. The translation «метакуля має вплив Negative» [metakulia maie vplyv Negative] maintains functional frame by reproducing interaction of the object with digital environment and subsequent rendering parameters. These instances indicate that for highly specific interface elements and mathematical rendering concepts, direct phonetic borrowing or the utilisation of established transliterations often provides higher frame stability than descriptive linguistic calques, ensuring the immediate cognitive recognition required in technical workflows.

In addition to single-word units and interface manipulators, frame-based analysis of the dataset exposes distinct translation behaviours concerning multiword and compound IT terms. For instance, term “Blank keyframe” (Sentence 11) is used as a compositional frame combining a temporal coordinate (“keyframe”) with a defined parametric state (“blank”). Ukrainian translation «Пустий ключкадр» [pustyi kliuchkadri] preserves this compositional logic, ensuring that both temporal axis and absence of animation data are cognitively mapped without distortion. Conversely, translation of

complex procedural instructions, such as “clear the offset transform” (Sentence 16) translated as «зчищається зсув трансформування» [zchyshchaietsia zsuв transformuvannia], revealing intrinsic difficulties in handling embedded procedural frames. English source term “offset transform” defines a highly specific mathematical displacement within a coordinate system. Corresponding translation «зсув трансформування» [zsuв transformuvannia] manages to retain core geometric parameters; however, utilisation of verb «зчищається» [zchyshchaietsia] introduces an incompatible physical maintenance frame into a mathematical operation. A frame-based translation would necessitate a verb activating a “data reset” or “parameter nullification” frame, rather than physical removal. Such instances underscore the fact that within highly specialised 3D modelling environments, conceptual integrity of multiword terms is dependent on accurate synthesis of constituent frame slots.

Conversely, the analysis reveals a series of terms where the translation is accompanied by significant frame shifts, primarily caused by loss of procedural and functional characteristics. For instance, the term “rigging” activates a specific procedural frame concerning the preparation of a digital model for animation, encompassing creation of bones and hierarchical linkages. However, Ukrainian equivalent, «оснащення» [osnashchennia], shifts the conceptual model towards a general technical notion of hardware assembly, unable to represent domain-specific functions of motion control. A comparable cognitive asymmetry can be noted in translation of multi-component term mesh “skin weighting” as «виважування сітьового покryвy» [vyvazhuvannia sitovoho pokryvu]. Although the structural imagery is partially retained, cognitive focus is displaced onto a material plane, thereby weakening procedural aspect of assigning deformation weights. Another prominent category of cognitive discrepancies involves unjustified transference of

specialised digital instrument concepts into physical domains. Specifically, within the context of 3D animation, the term “armature” functions as a technical frame denoting a skeletal structure for motion control; nevertheless, literal translation «арматура» [armatura] actualises a construction frame (metal reinforcement), effectively overlaying a dynamic animation instrument into a static physical material. Similarly, terms such as “lattice” (an auxiliary deformation grid) and “hook” (an instrument for local deformation control), translated respectively as «решітка» [reshitka] and «гачок» [hachok], forfeit their primary dynamic frame of influence, which structurally comprises a mechanism, an area of effect, and a deformation result. Ukrainian equivalents activate concepts of tangible physical objects, entirely omitting deformation procedure and the functional purpose of instruments within digital environment.

The persistent cognitive asymmetries observed in translation of terms such as “armature” and “rigging” expose a broader systemic vulnerability in standardisation of Ukrainian IT terminology. In this context, the discussion of the obtained results reveals profound correlations with recent studies in cognitive linguistics. For instance, N. Hinrichs *et al.* (2022) explored the concept of embodied metarepresentations in cognitive systems. The study addressed how human comprehension of complex, abstract systems relies heavily on fundamental physical and spatial frames. The results of the study correlate with presented findings regarding the successful translation of metaphorical IT terms such as “Grease Pencil” and “Exposure node”. Data and results of presented study also confirm that translation achieves optimal equivalence only when it meticulously preserves that specific metaphorical framing derived from physical world experiences.

Study by D. Hitcheva (2025) explored solutions for the issue of translation associated with terminological verb collocations in technical domains. The author found that active

procedural verbs dictate the activation of specific operational frames, and their syntactic mistranslation alters the entire cognitive structure of an instruction. Presented results regarding translation of the phrase “Skin the mesh” corroborate this finding. Presented results correlate with the conclusion of D. Hitcheva (2025) that preservation of functional syntax of operational frame is as critical as aligning isolated nouns, which is evident in presented dataset where an active procedural command was shifted into a passive description.

In a broader cognitive context, K. Sullivan (2023) investigated theoretical architecture of framing by delineating three distinct but interconnected levels: linguistic, cognitive, and discursive. The study concluded that discrepancies or alterations at the foundational linguistic level inevitably cascade, causing misalignments in cognitive representation and subsequent professional communication. Presented empirical findings substantiate this multi-level framing model. Obtained results correlate with K. Sullivan (2023), as analysis of terminological verb collocations, specifically shift from an active procedural command (“Skin the mesh”) to a passive state description, demonstrates that a minor syntactic alteration at the linguistic level fundamentally disrupts the cognitive frame of the user, shifting focus from executing a specific 3D modification technique to observing a spatial relationship.

Investigating multiword terms, J. Rojas-Garcia (2025) analysed variables for knowledge representation in specialised translation. The author revealed that misaligned semantic domains of adjectives, nouns, and governing verbs within compound terms inevitably result in hybrid frames that obstruct accurate knowledge representation. Presented findings regarding complex procedural instructions demonstrate identical translation behaviours. Conclusions presented in the study and by J. Rojas-Garcia (2025) fully correlate, as introduction of an incompatible physical maintenance

verb into a mathematical operation (“clear the offset transform”) in presented dataset confirms fragility of embedded procedural frames.

In a related context, J.F. Nwachukwu (2024) addressed theoretical modelling of translation process. The study determined that integration of frame analysis into every stage of pragmatic text translation shifts the focus from direct linguistic equivalents to recreation of operational logic of the subject matter. This correlates with presented observation that pre-translation frame modelling is a necessary competency. The conclusion of J.F. Nwachukwu (2024) correlate with presented results, as analysis of procedural terms such as “rigging” proves that traditional equivalence-based models are inadequate for highly dynamic technical domains.

T. Maslova & S. Fedorenko (2022) addressed cognitive approach to the interdisciplinary research of terminology. The study concluded that documentation of conceptual network provides cognitive context required to select accurate equivalents. Presented study confirms this premise, demonstrating that alphabetised, bilingual glossaries frequently fail to capture the multi-dimensional nature of IT nomenclature. Presented results and the study by T. Maslova & S. Fedorenko (2022) correlate, as transitioning to frame-based dictionaries is a viable solution to prevent terminologists from prioritising formal linguistic alignment over accurate conceptual mapping.

B. Sánchez Cárdenas (2024) studied the extraction of semantic frames from specialised corpora for lexicographic purposes. The study demonstrated that systematic frame extraction provides the empirical data required to construct advanced technical dictionaries. These results are consistent with presented approach. Presented study supports the findings of B. Sánchez Cárdenas (2024), as manual frame extraction from the Blender corpus proves that explicitly defining obligatory frame slots, such as the agent, instrument, and procedural result, is essential for capturing technical terminology.

The study by R. Resi (2024) investigated the management of terminological gaps between languages using concept systems and frames. The author concluded that frame-based methods are highly effective for detecting and bridging conceptual mismatches. These findings fully align with presented results, confirming that frame shifts cause significant cognitive asymmetries between English and Ukrainian IT texts. It is reasonable to agree with R. Resi (2024), whose empirical data demonstrate that without mapping conceptual integration, translators fail to preserve procedural integrity, leading to the unjustified transference of digital concepts into tangible physical domains.

Analysing translation from a different perspective, A. Bondarenko (2022) addressed the features of frame interpretation across different language pairs. The study determined considerable variability that frequently results in conceptual mismatches if the underlying domain logic is ignored. This mirrors presented findings regarding the superficial lexical correspondence found in the translation of terms such as “lattice” and “hook”. Conclusions correlate with the study by A. Bondarenko (2022), as the literal translation of these units serves as an example of domain logic ignorance, where dynamic mechanisms are incorrectly actualised as static tangible objects.

In the context of automated natural language processing, Y. Moslem *et al.* (2023) addressed domain terminology integration into machine translation by leveraging large language models (LLMs). The study determined that successful integration is fundamentally dependent on accurate conceptual framing. Presented analysis highlights the cognitive vulnerabilities inherent in translation algorithms. Presented results correlate with Y. Moslem *et al.* (2023), as automated systems frequently default to conceptually inaccurate nominative equivalents, which requires integration of domain terminology directly into the training architectures of translation models. Lastly,

F. Liu (2025) studied term dictionary automatic extraction algorithms based on BiLSTM neural networks. The study concluded that such automated systems are highly efficient in isolating and processing relevant vocabulary from massive datasets. While presented study relies on a manually curated dataset, the data correlates with F. Liu (2025) regarding the future scalability of frame analysis. Combining computational terminology extraction with automated frame mapping can be used to verify whether the cognitive asymmetries observed in this sample represent universal linguistic phenomena across the entirety of the IT domain.

Despite conclusive nature of observed frame shifts and cognitive discrepancies, it is necessary to acknowledge methodological limitations of presented study. Empirical sample, while representative of conceptual complexity inherent in 3D modelling discourse, is restricted to a manually curated dataset extracted from a single software documentation source. Qualitative, contextual-interpretative nature of manual frame analysis demonstrates specific terminological mechanisms; however, it limits immediate scalability of findings across entirety of IT domain. A prospective direction for future research must therefore encompass automated term extraction algorithms, such as those utilising BiLSTM neural networks, to isolate and process relevant vocabulary from larger, multidisciplinary datasets. Combination of large-scale computational terminology extraction with automated frame mapping can be used to verify whether cognitive asymmetries observed in the Blender documentation represent universal linguistic phenomena across different sub-domains of information technology and across diverse language pairs.

Conclusions

Conducted research on the translation of IT terminology from the perspective of linguistic-cognitive modelling demonstrates that

traditional lexical-equivalent approaches are insufficient for adequately reproducing the meaning of specialised terms in the highly dynamic field of information technology. Absence of an orientation towards the cognitive structure of a term inevitably leads to frame shifts, the simplification of procedural characteristics, and a critical loss of conceptual integrity, which subsequently impedes professional communication. Use of the FBT approach provides a systematic methodology for modelling of translation process, confirming that translation of IT terms must be approached as reconstruction of a conceptual model rather than a simple operation of linguistic substitution.

Empirical analysis of English-Ukrainian parallel corpus, extracted from 3D modelling and animation documentation, revealed varying degrees of cognitive equivalence. Established IT vocabulary, particularly terms associated with geometric, temporal, and interface-related conceptual domains, demonstrated a high level of frame correspondence and structural stability in target language. Conversely, innovative, multi-component, and procedurally oriented terms proved to be highly problematic. Translation of these specific units frequently resulted in cognitive discrepancies, including displacement of central frame slots, omission of procedural components, and unjustified substitution

of a specialised technical frame with a general or physical concept.

Consequently, frame-based approach serves as a highly effective analytical instrument for assessment of cognitive equivalence and detection of implicit terminological gaps between languages. Relevance of study results is determined by practical value for compilation of domain-specific glossaries, standardisation of Ukrainian IT terminology, and potential integration of structured conceptual networks into neural machine translation systems. Furthermore, these results establish a foundation for the formulation of theoretically grounded translation strategies. A prospective direction for future research involves expansion of present analysis to encompass larger, multidisciplinary corpora of technical documentation and exploring automated methods for extracting semantic frames to further refine lexicographic and translational methodology.

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Лінгво-когнітивне моделювання ІТ-термінів у перекладі: фреймовий підхід

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Анотація. Актуальність дослідження зумовлена стрімким розвитком інформаційних технологій та потребою в адекватному перекладі високодинамічної англомовної термінології інформаційних технологій українською мовою, що вимагає виходу за межі формальної лексичної відповідності задля забезпечення когнітивної еквівалентності. Мета роботи полягала у комплексному дослідженні можливостей фреймового аналізу як інструмента лінгво-когнітивного моделювання під час перекладу термінології інформаційних технологій. Для досягнення поставленої мети використано такі методи: описовий, контекстуально-інтерпретативний, фреймове моделювання, зіставний аналіз, а також підходи корпусної лінгвістики. На основі аналізу двомовного паралельного корпусу, сформованого з офіційної документації програмного забезпечення Blender, реконструйовано та зіставлено фреймові структури відібраних термінів із галузей 3D-моделювання та анімації. Встановлено, що усталена лексика інформаційних технологій, зокрема в межах геометричних, темпоральних та інтерфейсних доменів, демонструє високий рівень фреймової відповідності та структурної стабільності в мові перекладу. Натомість переклад інноваційних, багатокомпонентних та процедурно орієнтованих термінів часто призводить до значних когнітивних асиметрій. Фреймові зсуви виявляються насамперед у втраті процедурних характеристик, зміні функціонального синтаксису через пасивні дієслівні конструкції та невиправданому перенесенні концептів цифрових інструментів у матеріальну фізичну площину. Виявлено, що концептуальна цілісність багатокомпонентних термінів безпосередньо залежить від точного синтезу їхніх складових фреймових слотів. Лінгво-когнітивний аналіз дозволив виявити не лише структурні особливості термінів, а й ті концептуальні моделі, що лежать в основі втрати технічного змісту під час перекладу. Практичне значення дослідження зумовлене можливістю використання отриманих результатів для систематизації та вдосконалення підходів у галузевій лексикографії, покращення фахової підготовки технічних перекладачів, а також для оптимізації інтеграції структурованих концептуальних мереж у системи нейронного машинного перекладу

Ключові слова: когнітивна еквівалентність; концептуальне картування; номенклатура 3D-моделювання; доменна лексика; процедурна семантика