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Structural and semantic types of predicates in the Latin language

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Abstract. The syntactic theory is undergoing dynamic development within linguistic scholarship, with growing scholarly interest in the syntactic structure of the Latin language. This study aimed to analyse the structural and semantic types of predicates within the semantic-syntactic structure of the sentence. The research employed a comprehensive set of methods, ranging from morphological to contextual analysis, combining both qualitative and quantitative approaches. Information from various sources on the predicate as a distinct type of main sentence constituent – characterised by a range of specific features – has been systematised, and the parameters of its functioning have been described. The study addressed the issue of syntactic relationships between sentence constituents – namely, the predicate as the main sentence constituent and the subordinate elements that together form the sentence structure, convey its core meaning, and determine its specificity. The positional placement of the predicate within the sentence structure was analysed, along with its stylistic function, differential features, and forms of expression. It was substantiated that the predicate constitutes the semantic and grammatical core of the sentence and is structurally non-uniform. The study examined the structural and semantic types of predicates in the Latin language, clarified and systematises existing data on their classifications, and defined the place of each type within the overall typology of predicates. It identified the means by which compound verbal predicates are extended through the use of modal components and substantiates that the modal meaning conveyed in a sentence depends both on the morphological composition of the compound verbal predicate and on the choice of linking verbs. It was noted that when a verbal base forms part of a compound verbal predicate, the means of expression conveys the corresponding modal meaning of the predicate. The forms

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of realisation of both verbal and compound nominal predicates are outlined, their usage within sentences is explored, and their functions are supported with examples. The findings contribute to a broader understanding of the syntactic structure of the Latin language. The results concerning structural and semantic types of predicates may be applied in future theoretical research on the semantic-syntactic structure of the sentence

Keywords: syntax; sentence structure; predicative relationship; predicate; simple verbal predicate; compound verbal predicate; compound nominal predicate

Introduction

Latin, as the foundation of many modern European languages, continues to exert considerable influence on the formation of their grammatical structures. The relevance of studying predicates lies in its potential to enhance the understanding of the development of syntactic relations and semantic functions in the Romance languages, as well as in other languages shaped by Latin influence. The predicate is a central element of the sentence in any language, and its analysis in Latin contributes to a broader understanding of universal grammatical principles – an area of particular importance to linguists engaged in comparative-historical language studies. Latin remains widely used in scientific terminology, law, theology, and various other fields. A sound understanding of its syntactic functions, especially the role of predicates, supports accurate interpretation of texts and their adaptation to contemporary usage. Investigating predicates offers deeper insight into how syntax and semantics interact in Latin, enabling the identification of connections between sentence structure and meaning, and revealing patterns that may have influenced the development of grammatical categories in modern languages. An understanding of a language's grammatical system allows for a deeper grasp of its structure and facilitates the translation of Latin texts. The study of the structural and semantic types of predicates in Latin is essential for gaining deeper insight into the Latin syntactic system, particularly the interrelation between form and meaning within the sentence. As the central component of the predicative structure, the predicate determines the nature of syntactic relationships within the sentence and conveys key grammatical categories such as mood, tense, person, and number. The analysis of Latin predicates enables the tracing of syntactic construction development within the language system, highlights the specific combinability of verbal and nominal forms, and sheds light on the principles underlying the structural organisation of the language. Within this framework, particular attention is paid to the distinctions between simple, compound, analytical, and other types of predicates, as well as to their functioning across various genres and styles of Latin. This contributes to a broader understanding of the semantic flexibility and syntactic versatility of this classical language.

Problems of syntax remain a focus of interest for many scholars and are investigated across a wide range of languages. The syntax of the Latin language continues to attract the attention of contemporary linguists, particularly within the fields of historical linguistics, syntactic theory, and comparative linguistics. Numerous prominent international scholars have examined, or continue to explore, various aspects of Latin syntax. H. Pinkster (2021) made a significant contribution to the study of Latin semantics and pragmatics, as well as to syntax, by applying modern linguistic theories and concentrating on the sentence and its predicative core – namely, the subject and predicate. S. Aerts (2021) explored the role of grammatical

aspect within the Latin tense system, describing three levels of meaning – referential, textual, and interpersonal – and analysed "tense" and "aspect" as categories connected to the communicative intentions present in narrative tenses. T. Burkard & M. Schauer (2020) emphasised the importance of Latin syntax and semantics, provided a detailed description of the predicate and subject-predicate agreement, and examined in depth several theoretical and practical issues in syntax that have been, and in many cases remain, of scholarly concern. H. Riemsdijk (2021) examined the interaction between syntactic structures and other linguistic levels, presenting a modern approach to the study of syntax across various languages, including Latin, with an emphasis on comparative analysis. He outlined the principles of universal grammar as shared between phonology and syntax. B. Spieralska-Kasprzyk (2021) investigated syntactic and semantic coreference in Latin (prefix *co-* from Latin meaning "together" and *ferens* (*ferentis*) referring to a subject of thought with which a linguistic expression correlates), is based on the shared informative-referential content of a sentence and the structuring of linguistic units (subject, predicate, and other minor sentence constituents). These researchers, along with many others, have contributed to a renewed understanding of the Latin language. Their studies hold not only historical value but also practical significance for modern linguistics, helping to bridge classical languages with contemporary grammatical theory. Nevertheless, there remains a need to further develop the analysis of predicates within the semantic-syntactic structure of the sentence and to systematise knowledge of the types of predicates in Latin and how they are expressed.

The study of Latin syntax in contemporary Ukrainian scholarship is multifaceted, encompassing a range of approaches – from traditional philology to the application of computational linguistics. L. Shevchenko (2023) argued that in the 20th and 21st centuries, the scope of Latin usage has begun to expand once more, accompanied by growing interest in restoring its function as a supranational means of communication. A number of Ukrainian scholars have made significant contributions to this field. In particular, the typology of predicates has been addressed within Ukrainian linguistic research, primarily by scholars of classical philology. Ukrainian researchers studying predicates in the Latin language have focused on its grammatical structures and syntactic features. Among those engaged in the study of Latin and its syntax within Ukrainian classical philology are several notable figures. B. Chernyukh (2022) explored the concept of Vulgar Latin, analysing its phonetic, morphological, and syntactic developments. I. Romaniuk (2023) examined the semantic-syntactic features of polyprefixal verbs in Late Latin and argued that the semantic properties of a verb determine its valency potential and influence the selection of actants.

The syntactic structure of the sentence and the expression of its principal components – the subject and predicate – remain central to the research of many contemporary linguists, approached from the perspectives of various languages and theoretical frameworks. N. Zdorovets (2023) paid particular attention to the functional and structural characteristics of Ukrainian, English, and Crimean Tatar, offering new insights into the interaction of different linguistic systems. Yu. Vaseiko & T. Masytska (2021) examined the features of the compound nominal predicate in the legislative variety of the official business style. T. Chuban & L.V. Kardash (2020) synthesised information on predicative constructions as a distinct type of main sentence constituent, highlighting a set of specific features. These linguists outlined the parameters of predicate functioning and emphasised that predicates are not structurally uniform and have their own morphological means of expression. V. Molotskyi (2024) attempted to clarify and systematise information on the complex compound nominal predicate,

identifying its modal components as key means of structural complication.

However, a review of recent publications reveals a lack of studies specifically focused on the predicate as the main sentence constituent in Latin. In most cases, this topic has been addressed only within broader investigations of Latin syntax, while no dedicated research has explored the typology of predicates in its own right. Consequently, the study of predicates based on Latin material is both timely and worthy of thorough scholarly attention. There remains a need to refine the formal and grammatical features of predicates, analyse how they are expressed, and justify their typology according to the means of conveying modal and temporal meanings. This study aimed, therefore, to identify and systematise the structural and semantic types of predicates in the Latin language, to describe their grammatical and semantic characteristics, and to reveal patterns of their use within the context of Classical Latin literature.

Materials and Methods

The source material for this study included the Latin-Ukrainian Dictionary (Trofymuk & Trofymuk, 2001) and the Ukrainian-Ancient Greek-Latin Dictionary (Boyko & Myronova, 2012). The factual linguistic data were drawn from a diverse range of Latin literary works, from which sentences exemplifying the structural and semantic types of predicates in Latin were extracted using a method of continuous and representative sampling. The total sample size comprises over 200 units, representing works by the following authors: T. Maccius Plautus *Aulularia* (Pl.xAul.), *Miles Gloriosus* (Pl Mil.), *Amphitrio* (Pl. Am.), *Persa* (Pl. Per.), *Epidicus* (Pl. Epid.); M. Tullius Cicero *Cato* (C Cat.), *Tusculanae disputationes* (C. Tusc.), *Epistulae ad familiars* (C. Fam.), *Pro Sestio* (Sest.), *De legibus* (C. Leg.), *De Inventione* (C. Inv.), *De republica* (C. Rep.), *Divinatione* (C. Div.), *Pro Sestio* (C.Sest.), *De finibus bonorum* (C. Fin.), *Pro rege Dejotaro* (C. Dej.), *De Officiis* (C. Off.) *Philippicae* (C. Phil.), *De natura deorum* (C. N. D.); Cornelius Tacitus *Germania* (Tac. G.), *Annales* (Tac. A.); G. Valerius Catullus (Catul.); T. Livius *Ab Urbe condita* (Liv.); C. Julius Caesar *De bello Gallico* (Caes. B. G.); Cornelius Nepos *Agaesilaus* (Nep. Ag.), *Epaminondes* (Nep. Ep.); Albius Tibullus (Tib.); Apuleius *Apologia* (Apul. Apol.); M. Claudius Marcellus (Marc. Fam.); L. Annaeus Seneca *Epistulae* (Sen. Ep.); Valerius Maximus (Val. Max.); M. Terentius Varro *Res rusticae* (Varr R. R.); P. Ovidius Naso *Metamorphoses* (Ov. Met.).

The methods used to invesxtigate the structural and semantic types of predicates in Latin were based on a comprehensive analysis of linguistic phenomena. The first stage of the research employed a selective sampling method, involving the extraction of linguistic material from the aforementioned sources. Attention was focused on selecting sentences that were representative of analysing structural and semantic types of predicates. This approach made it possible to identify how predicates function within sentences and to determine their specific features. The method of observation was used to trace the functioning of predicates in context, to collect and examine relevant examples, and to classify the structural and semantic types of predicates.

Following the selection and systematisation of the predicates, morphological analysis was conducted. This included the study of formal grammatical features, morphological realisation, syntactic roles, and semantic characteristics of predicates. The analysis centred on the means of predicate realisation through verb forms (simple verbal predicates), constructions involving linking verbs and predicative components (compound nominal predicates), and the use of modal elements (compound verbal predicates). Particular interest was given to comparing the Latin system with analogous structures in other languages, which provided a deeper understanding of the patterns governing predicate function as a key element of the sentence at both syntactic and morphological levels.

The study of the structural and semantic types of predicates in Latin involved an analysis of syntactic constructions, which helped to reveal the particular ways in which formal and semantic components are combined within the sentence. As the primary bearer of predicativity, the predicate in Latin exhibits a complex system of expression, encompassing both simple forms (verbal and nominal) and compound forms (notably constructions with auxiliary verbs or copulas). The semantic classification includes aspects such as action, state, relation, or modality, while the structural analysis focuses on the syntactic means of predicate formation, including case and word order. This integrated approach made it possible to identify patterns of usage in both Classical and Late Latin, especially regarding their function in conveying the stylistic and communicative aims of a text. The semantic analysis covered a variety of formal structures, including both simple and compound predicates, and explored their semantic function in the context of expression. Particular attention was given to the ways in which predicativity is conveyed through verbal forms, combinations with nouns or adjectives, and impersonal constructions.

The study of structural and semantic types of predicates in the Latin language focused on analysing the relationship between grammatical form and semantic content. This approach enabled the identification of patterns in predicate functioning across different syntactic constructions. The structural aspect of the analysis provided a classification of predicates according to their form of expression (simple or compound), while the semantic component examined their meanings – whether denoting action, state, or relation. Particular attention was given to the transformation of predicative structures in connection with the evolution of Latin, which helped to reveal both universal linguistic patterns and features specific to Latin in the context of its historical development.

The comparative-historical method used to investigate the structural and semantic types of predicates in Latin involved analysing the evolution of these constructions within the context of related Indo-European languages. This approach made it possible to trace the origins and development of predicate forms and to identify both commonalities and differences arising from historical shifts, language contact, and the internal dynamics of Latin. The application of this method also facilitated the reconstruction of Proto-Indo-European roots, clarified the functional and semantic characteristics of various predicate types, and revealed their role in the syntactic structure of the sentence. Moreover, it sheds light on their influence on subsequent stages in the development of the Romance languages.

The quantitative method used in the study of structural and semantic types of predicates in Latin involved the systematic analysis of sentences to identify and statistically account for various types of predicates. This approach included the classification of predicates according to their structural characteristics (simple or compound) and semantic features (verbal, nominal, descriptive, etc.). A corpus of texts was compiled to represent different styles and historical periods of the Latin language. Each predicate was identified, categorised according to defined parameters, and counted. The collected data were then analysed using statistical methods to uncover patterns in the usage of predicates in Latin. This allowed conclusions to be drawn regarding their evolution, functions, and frequency in different contexts.

The diachronic approach to the study of structural and semantic types of predicates focused on their development across different chronological stages – from Archaic Latin to Late Latin. This method enabled the identification of changes in the structure and semantics of predicates under the influence of internal linguistic processes such as grammaticalisation,

syntactic reorganisation, and lexical-semantic enrichment, as well as external factors including language contact and sociohistorical transformations. Such analysis helped to establish patterns in the development of predicative constructions, to distinguish between innovative and archaic elements, and to outline their impact on the formation of syntactic structures in Neo-Latin and modern Romance languages.

Results and Discussion

The study of the predicate in Latin has been a central aspect of grammatical scholarship for centuries. Significant contributions have been made by both ancient and modern scholars. Significant contributions have been made by both ancient and modern scholars. The eminent Roman philologist M. Terentius Varro (1910) provided detailed descriptions of the parts of speech, examined Latin syntax, and explored sentence constituents such as the subject and predicate. According to L. Zvonska *et al*. (2017), Varro's studies – including *De Lingua Latina*, *De Sermone Latino*, *De Similitudine Verborum*, *De Utilitate Sermonis*, *De Origine Linguae Latinae*, and *De Antiquitate Litterarum* – remain valuable sources for the study of Latin grammar. The most comprehensive grammatical treatise of Late Antiquity, *Institutiones Grammaticae*, authored by the Roman grammarian Priscian, presents an in-depth treatment of Latin syntax, including sentence components, supported by examples from classical authors. This grammar served as a foundational text for Latin language instruction throughout the Middle Ages.

Establishing syntactic connections between sentence constituents in Latin presents a complex and multifaceted challenge. This is largely due to the unique characteristics of the Latin language, particularly its inflectional structure, which can complicate the straightforward identification of relationships between sentence constituents. Latin is based on the inflectional principle, meaning that the grammatical functions and meanings of words depend on formal changes in their endings. The syntactic relationship between the subject (*subiectum*) and the predicate (*praedicatum*) is ensured through agreement in number and person, which constitutes a fundamental principle of sentence construction and determines the grammatical correctness of the utterance. Linguist A.L. Sihler (1995) authored a comparative grammar of Greek and Latin, in which he thoroughly analysed Latin syntax and sentence structure, paying particular attention to sentence constituents, especially the predicate as a distinct type of main sentence constituent. B. Chernyukh (2017) conducted a diachronic analysis of the evolving relationship between aspectual semantics and actional types of predicates. He distinguished the kinds of action conveyed by Latin verbs, modelled the functional-semantic field of aspect, and examined the Latin verb in terms of aspectual markers – identifying features such as limitativity, phase, duration, multiplicity, and intensity. L. Zvonska *et al.* (2017) characterised the predicate (*praedicatum*) as the main sentence constituent that expresses the action, being, state, or quality of the subject. They described two structural and semantic types of predicates: the simple verbal predicate and the compound nominal predicate.

The *praedicatum*, when expressed by a verb, always agrees with the *subiectum* in number and person. The position of the *praedicatum* within the sentence is a significant aspect of Latin syntax, as it shapes the logical structure of the utterance and governs the interaction between its elements. Latin is classified as a language with relatively free word order; however, certain conventions and rules influence the placement of the predicate depending on style, context, and rhetorical purpose. In Classical Latin, the predicate most commonly appears at the end of the sentence, a placement that serves to emphasise the completeness of the thought and highlight the predicate as the central element of the statement: "*Qui sibi, quicquid tetigerint,* ***tenent***" (Pl. Aul. 2.2.21) – "Everything they touch, they

keep for themselves". Classical Latin word order is often described as SOV (Subject-Object-Verb). While the predicate usually occupies the final position, it may be repositioned to meet stylistic or rhetorical demands. According to observations by S. Demo (2012), linguistic models can offer a more robust framework for understanding these variations, highlighting the need for ongoing revision and refinement to ensure both the practical applicability and theoretical soundness of Latin grammar.

The positional arrangement of the predicate in Latin follows several models: 1) classical model (SOV) – the predicate appears at the end of the sentence, e.g. *Tempus vulnera* ***sanat*** – "Time heals wounds". 2) emphatic model (VSO) – the predicate comes first to emphasise the action, e.g. ***Sanat*** *tempus vulnera* – "Heals time wounds". 3) object-focused model (OSV) – the object precedes the subject, with the predicate remaining at the end, e.g. *Vulnera tempus* ***sanat*** – "Wounds time heals". 4) Inversion (OVS or VOS) – used for stylistic emphasis on the action or object, e.g. *Vulnera* ***sanat*** *tempus* – "Wounds are healed by time"; ***Sanat*** *vulnera tempus* – "Heals wounds time". 5) Ellipsis (VO or OV) – the subject is omitted and understood from context, e.g. ***Sanat*** *vulnera* – "Heals wounds"; *Vulnera* ***sanat*** – "Wounds heals". According to O. Vasylevska (2013), the verb-predicate, which traditionally occupies the final position in Classical Latin, gradually shifts towards the middle or even the beginning of the sentence. This change in placement was often triggered by the use of adverbial words or constructions at the start of the sentence, or by the precedence of another main or subordinate clause.

In complex structures – particularly in poetic texts or rhetorical speeches – the word order in Latin may shift to achieve stylistic effects. Placing the predicate at the beginning of the sentence can serve to emphasise the action, while positioning it in the middle often contributes to a more balanced sentence structure. An analysis of predicate positioning in Latin sentences reveals that its placement also depends on syntactic relationships. In subordinate clauses, the predicate frequently appears at the end, aligning with the general tendency of Latin to conclude syntactic blocks with a verb. For instance: "*Ubi abductas senserant legiones, agros* ***incursabant***" (Liv. 2.48.5) – "When they perceived that the legions had been withdrawn, they attacked the fields"; "*Neque, dum eram vobiscum, animum meum* ***videbatis***" (C. Cat. m. 22.79) – "Nor, while I was with you, did you see my soul"; "*Danubius plures populos adit, donec in Ponticum mare sex meatibus* ***erumpat***" (Tac. G. 1.4) – "The Danube passes through the lands of many peoples until it flows into the Black Sea through six channels". According to B. Comrie (1981), the study of syntactic typology, including universal features of predicates, constitutes a key aspect of syntactic analysis. Thus, predicate placement in Latin is flexible and influenced by grammatical conventions as well as the speaker's stylistic and rhetorical intentions. This variability enables Latin to convey meaning effectively while also contributing to the artistic expressiveness of the text.

The forms of expressing the predicate (*praedicatum*) in Latin are varied, and their selection depends on the syntactic structure of the sentence and the type of utterance. The Latin predicate exhibits a wide range of forms and functions, allowing for precise expression of meaning and logical relationships within a sentence. It may be realised through a finite verb (*verbum finitum*), which changes according to person, number, tense, mood, and voice. For example: "*Num ille te nam* ***novit***?" (Pl. Mil. 924) – "Does he know you?", where *novit* (knows) functions as a simple predicate. In addition, the predicate may be compound, particularly when the main verb is accompanied by auxiliary elements, such as in constructions involving the infinitive: "*Loquor de doctore homine, cui vivere* ***est cogitare***" (C. Tusc. 5.38.111) – "I speak of a learned man for whom to live is to think". The defining features of the predicate are most

evident in its close relationship with the subject, especially in verb agreement. For instance, when the subject is plural, the predicate must also be plural: "*Soles occidere et redire* ***possunt***" (Catul. 5.4) – "Sunny days can pass and return".

A notable feature of the Latin language is the presence of verb forms that have no direct equivalents in many modern languages, such as the gerund and supine, both of which may form part of the predicate. The gerund often replaces the infinitive when functioning as an indirect object, while still preserving verbal government. For example: "*Fessis* ***labore et pugnando*** *quies data militibus*" (Liv. 21.35.5) – "To the soldiers, exhausted by toil and fighting, rest was given"; "*Totius fere Gallie legati ad Caesarem* ***gratulatum*** *convenerunt*" (Caes. B. G. 1.30.1) – "Envoys from nearly all of Gaul came to Caesar to congratulate him". Modality in the predicate is conveyed through the moods of the verb: the indicative expresses reality, the subjunctive indicates possibility, desire, or conditionality, and the imperative conveys command. For example: "***Cura****, ut valeas*" (C. Fam. 12.29.3) – "Take care to stay well" (imperative). Negation within the predicate structure is typically formed using the particle *ne*: "*Amemus patriam, pareamus senatui, consulamus bonis, praesentes fructus* ***neglegamus****, posteritatis gloriae serviamus*" (C. Sest. 68.143) – "Let us love our country, obey the Senate, care for the good, forgo immediate gain, and strive for the glory of posterity".

Within sentence structure, the predicate plays a key role, defining both the grammatical and semantic meaning of the utterance. According to I. Melnyk (2019), the predicate in a sentence possesses a set of formal grammatical categorical features and variable forms of expression. Many linguists distinguish two primary realisations of the predicate – the verbal predicate and the compound nominal predicate. As noted by L. Zvonska *et al.* (2017), the simple verbal predicate is processual in nature, while the compound nominal predicate is qualificative. In the texts under analysis, the verbal predicate is represented in two forms: the simple verbal predicate and the compound verbal predicate. Each of these forms has its own characteristics and means of usage within a sentence.

The simple verbal predicate (SVP) functions as the main sentence constituent expressing an action, state, or process. It agrees with the subject in number and person and may also reflect tense, mood, or voice. Based on the observations, the SVP typically consists of a single verb that does not require auxiliary elements to convey an action or state. For example: "*Aliis* ***coluit****, non sibi*" (Pl. Am. 17.49) – "He cared for others, not for himself"; "*Prior horum apud Massagetos in proelio* ***cecidit***" (Nep. Ag. 21.1.2) – "The first of them fell in battle against the Massagetae"; "*Conon pecuniae quinquaginta talenta civibus suis* ***donavit***" (Nep. Ep. 9.4.5) – "Conon gifted fifty talents to his fellow citizens"; "*Balbus Actium majestatis* ***postulaverat***" (Tac. A. 6.47) – "Balbus accused Actius of treason"; "*Pectora tristitiae dissoluenda* ***dedit***" (Tib. 1.7.40) – "He surrendered his heart to be freed from sorrow"; "*Haud equidem ullius civis fortunae aut condicioni* ***invideo***" (Liv. 22.59.10) – "Indeed, I do not envy the fortune or position of any citizen".

The most common means of expressing the simple verbal predicate (Table 1) is through the finite verb form. For instance: "*Veneti navium quod ubique fuerat in unum locum* ***coegerant***" (Caes. B.G. 3.16.2) – "The Veneti had gathered in one place all the ships that had been scattered everywhere". Here, *coegerant* (had gathered) is a finite verb in the active voice, past perfect tense, third person plural. Another example: "*Quam multos divini supplicii metus a scelere* ***revocavit***" (C. Leg. 2.7.16) – "How many people the fear of divine punishment has turned away from crime". The verb *revocavit* (turned away) functions as a simple verbal predicate, active voice, perfect tense, third person singular. A simple verbal predicate may be expressed by a single verb form in the indicative mood, for example, in the perfect indicative (past tense): "*Eriphyle auro viri vitam* ***vendidit***" (C. Inv. 1.50.94) –

"Eriphyle sold her husband's life for gold". The simple verbal predicate is conveyed by a verb that agrees with the subject in gender, number, and person: "***Speremus*** *nostrum nomen volitare latissime*" (C. Rep. 1.17.26) – "Let us hope that our name will spread far and wide", where *speremus* (let us hope) functions as an SVP because the verb is in a simple form and lacks additional nominal components or auxiliary verbs. The phrase *volitare latissime* (to spread far and wide) is a dependent construction (an infinitival complement) and is not part of the core predicate. In the sentence "*Nec me* ***pudet*** *fateri nescire*" (C. Tusc. 1.25.60) – "I am not ashamed to admit that I do not know", the simple verbal predicate is the verb *pudet* (I am ashamed), which indicates an emotional state. The verbs *fateri* (to admit) and *nescire* (not to know) are infinitives functioning as complements or adverbial modifiers within the broader expression of thought. An SVP may also be expressed using impersonal forms that lack a clearly defined subject: *Pluit* – *It is raining* (*pluit* is an impersonal verb in the third person singular, present tense).

Table 1. *Means of expressing the simple verbal predicate (SVP)*

Element	Description	Example
Personal form	the predicate is expressed using a personal verb form	"*Mella* ***decussit*** *foliis*" (Verg. G. 1.131) – "He shook the honey from the leaves"
Verb	the predicate is expressed by a verb that agrees with the subject	"*Terra* ***sudat*** *sanguine*" (Stut. Th. 8.41.6) – "The earth sweats with blood"
Infinitive	the predicate is expressed by an infinitive	***Vivere*** *est cogitare* – To live is to think
Tense	the predicate expresses an action occurring in a specific tense	"*Partes tres, quarum unam* ***incolunt*** *Belgae*" (Caes. B. G. 1.1.1) – "Three parts, one of which the Belgae inhabit"
State	the predicate is expressed using a verb in the passive voice	"*Cujus auctoritas in iis regionibus magni* ***habebatur***" (Caes. B. G. 4.21.7) – "Whose authority was highly regarded in those regions"
Mood	the predicate is expressed using a verb in the imperative mood	"***Vide****, ornatus hic satine me condecet?*" (Pl. Ps.93.5) – "Look, does this attire not suit me well enough?"

Source: *compiled by the author*

The Simple verbal predicate may be expressed in the passive voice, where the action is directed towards the subject: "*Eodem anno Quintus Fabius Maximus* ***moritur*** *exactae aetatis*" (Liv. 30.26.7) – "In the same year, Quintus Fabius Maximus dies at an advanced age" (*moritur* – passive verb form in the present tense, third person singular); "*Est periculum, ne impia fraude* ***obligemur***" (C. Div. 1.4.7) – "There is a danger that we may be bound by wicked deceit"; "*Mihi ante oculos* ***obversatur*** *rei publicae dignitas*" (C. Sest. 3.7) – "The dignity of the Republic appears before my eyes". In imperative sentences, the SVP is expressed by a verb in the imperative mood: ***Divide*** *et* ***impera*** – Divide and rule. Due to its flexible inflectional system, Latin allows for precise expression of the relationship between subject and predicate, even when word order varies.

The compound verbal predicate (CVP) exhibits several characteristic features that distinguish it from other predicate types. Its main function is to express a complex action or state using an auxiliary verb combined with a main verb in the infinitive form. According to T. Mishenina (2002), the CVP pattern "to have + infinitive" acquires four semantic meanings: obligation, compulsion, intention, intention-desire, and a formal function in the formation of the future tense. In Latin, the CVP is formed by combining a linking verb with other elements such as infinitives, participles, or verbs in

active or passive forms. This construction allows for the expression of various aspects of action, modality, and nuances of tense or condition: "L*ucius Titius et Gaius Seius Publico Maenio decem* ***dare damnas*** *sunto*" (Apul. Apol. 30.122) – "Let Lucius Titius and Gaius Seius be obliged to give ten measures to Publius Maenius"; "*Nudata omnibus rebus tribunicia* ***potestas est***" (Caes. B.C. 1.7.3) – "The office of the tribunes was stripped of all powers"; "*E virtute, id* ***est*** *honeste,* ***vivere***" (C. Fin. 2.11.34) – "To live according to virtue – that is, honourably"; "*Antiochus, rex Asiae, a Scipione devictus, Tauro tenus* ***regnare*** *jussus* ***est***" (C. Dej. 13.36) – "Antiochus, king of Asia, defeated by Scipio, was ordered to reign only as far as the Taurus Mountains". In many instances, the verb *esse* functions as the predicate and may indicate a state or fact of existence. When the predicate is expressed by the infinitive form of *esse*, it is often omitted: "*Sentimus calere ignem, nivem esse albam, dulce mel*" (C. Fin. 1.9.30) – "We sense that fire is hot, snow is white, and honey is sweet". In the construction *accusativus cum infinitivo*, the predicate includes a form of *esse*, which is likewise frequently omitted: "*Nun tantum significandum putavi, ut potius amorem tibi ostenderem meum, quam ostenderem prudentiam*" (C. Fam. 10.3.4) – "Now I thought it necessary to indicate only this: that I would rather show you my affection than my wisdom".

The CVP is realised through the use of an auxiliary verb indicating modality, desire, intention, possibility, or obligation, followed by the infinitive of the main verb. For example: "***Non possum*** *tecum* ***vivere*** *sine odio*" (Marc. Fam. 5.14.3) – "I cannot live with you without hatred"; "***Volo discere****, non disputare*" (C. Off. 3.23) – "I want to learn, not to argue"; "*Homo* ***debet servare*** *iustitiam*" (C. Leg. 2.4.10) – "A person ought to uphold justice"; "***Soleo meditari*** *de philosophia*" (Sen. Ep. 5.17.23) – "I usually reflect on philosophy". In the structure of a CVP, the infinitive carries the main semantic content, while the auxiliary verb specifies the context or modality of the action. The auxiliary verb agrees with the subject in number, person, and tense, whereas the infinitive remains invariable. In the sentence "*Laudem sapientiae* ***statuo esse maximam***" (C. Fam. 5.13.1) – "I consider praise for wisdom to be the highest (form of praise)", the predicate is compound and expressed in two parts: *statuo* is the main verb of the sentence (transitive, active voice, indicative mood, present tense, first person singular), meaning "I consider", and *esse maximam* (to be the greatest) is an infinitival phrase forming part of the compound predicate. The infinitive *esse* (to be) functions as a linking verb, while the adjective *maximam* (the greatest) serves as a predicative attribute.

In the analysed texts, the CVP serves as a means of conveying modal and temporal nuances of action. For instance, in the sentence "*Omni in re consensio omnium gentium lex naturae* ***putanda est***" (C. Tusc. 1.13.30) – "The agreement of all peoples in every matter ought to be considered the law of nature", the compound verbal predicate *putanda est* forms the core of the utterance, expressing the main action (ought to be considered). This is realised through the grammatical construction *gerundivum + esse*, which denotes necessity and is rendered in English as "ought to be considered". The use of compound verbal predicates adds precision and semantic depth to the structure of the sentence. In the sentence "*Universae Galliae consensio* ***fuit libertatis vindicandae***" (Caes. B. G. 7.76.2) – "It was the will of all Gaul to claim their freedom", the CVP consists of the linking verb *fuit* (was) – the past tense form of *esse* – and the gerundive phrase *libertatis vindicandae*, which functions as a predicative complement denoting the action.

In certain constructions, the CVP may include a participle in combination with the linking verb *esse*: "*Hasdrubal Carales* ***perventurus erat****, ni Manlius eum populatione continuisset*" (Liv. 23.40.8) – "Hasdrubal would have reached Caralis, had not Manlius halted his raid". The

compound verbal predicate *perventurus erat* consists of the auxiliary linking verb *erat* in the imperfect indicative active form, indicating the tense of the action, and the future participle *perventurus* in the nominative case, derived from the verb *pervenire* (to arrive, to reach). This construction denotes an incomplete, potential future action. In the sentence "*Omnia mortalium opera mortalitate* ***damnata sunt***" (Sen. Ep. 91) – "All the deeds of mortals are condemned to mortality", the CVP *damnata sunt* is formed by combining the auxiliary verb *esse* (expressing tense, number, and voice) and the past passive participle *damnata*, which conveys the state or result of an action. In the sentence "*Inimicus patriae fuisse Tiberius Gracchus a patriciis* ***existimatus est***" (Val. Max. 4.7.1) – "Tiberius Gracchus was considered an enemy of the state by the patricians", the CVP *existimatus est* consists of the auxiliary form of *esse* and the participle *existimatus*, expressing a completed action.

According to R. Khrystianinova (2016), the components of a CVP must satisfy two conditions: 1) both verbs (the auxiliary and the infinitive) must relate to the subject; from a semantic-syntactic perspective, the infinitive denotes an action or state of the subject, making it subject-related. 2) both verbs must belong to the same temporal frame. In the analysed texts, the CVP typically consists of two components: "*Extra familiam* ***debuit dicere*** *vilicum et vilicam*" (Varr. R. R. 1. 18. 3) – "Apart from the household, he was obliged to name the steward and stewardess". In the predicate *debuit dicere*, the first component *debuit* is a modal verb in a perfect active tense, expressing obligation or necessity (he was obliged to), while the second component *dicere* is an infinitive, indicating the action to be performed (to name). "*Pompejus rem ad arma* ***deduci studebat***" (Caes. B. C. 1. 4. 5) – "Pompey endeavoured to bring the matter to arms". The CVP *studebat deduci* includes *studebat* as an auxiliary verb expressing desire or intention, and *deduci* (the passive infinitive of *deducere*) as the core verb expressing the main action. "*Senatui* ***placet*** *Crassum provintiam Syriam* ***obtinere***" (C. Phil. 11. 12. 30) – "The Senate favours Crassus taking control of the province of Syria". Here, the CVP consists of the verb *placet* combined with the infinitive *obtinere*, forming a unified expression of preference or approval.

In the context of a sentence, the CVP expresses the subject's obligation to perform an action – "was obliged to name". In complex sentences, where the predicate of the main clause is in the perfect tense, the imperfect is used to indicate a simultaneous past action: "*Pastum animantibus large et copiose natura eum, qui cuique aptus erat, comparavit*" (C. N. D. 2. 47. 121) – "Nature provided generous and abundant pastures for animals, suited to each species".

The compound verbal predicates are formed by combinations of auxiliary and main verbs. The primary structural patterns of the CVP (Table 2), which enable the expression of various temporal aspects – past, present, and future – include: linking verb + infinitive, used to express modal meanings such as obligation, possibility, or desire; linking verb + perfect infinitive, which conveys completed actions within a modal or temporal context; linking verb + participle, indicating a state or completed action; auxiliary verb + gerund or gerundive, used to express ongoing action or general necessity; verbs of state (*sum*, *fio*) or motion (*venio*, *eo*) with additional elements, which signal the course of action; construction with *esse* + infinitive or supine, which conveys nuances of necessity or intended purpose in the predicate. In the examined texts, the CVP is further developed through modal elements, which introduce various shades of meaning. These modal components influence the expression of possibility, necessity, permission or ability, thereby altering the overall sense of the sentence. This is achieved through the use of auxiliary verbs, modal verbs, or other constructions that reflect modality. For instance: "*Homo debet esse sapiens*" – "A person ought to be wise" (necessity);

"*Homo debet esse sapiens*" – "This man may be powerful" (possibility). Such modal verbs serve as a means of enriching the CVP, allowing it to convey modality as an integral part of the compound predicate. In the lexicographic material (Boyko & Myronova, 2012), the following verbs are recorded as expressing various modal meanings: *posse* – indicating possibility; *debere* – indicating necessity or obligation; *velle* – indicating desire or intention; *nolle* – indicating refusal or unwillingness. Within a compound predicate, modality may also be expressed not only through modal verbs but also through modal adverbs. The Latin-Ukrainian dictionary by M. Trofymuk & O. Trofymuk (2001) includes modal adverbs such as *fortasse* (possibly), *certe* (certainly), and *videtur* (it seems), all of which are commonly found in the analysed texts. For example: "*Fortasse hic vir sapiens est*" (Val. Max. 4. 7. 5) – "Perhaps this man is wise".

Table 2. *Main forms of expressing the CVP*

Form of compound verbal predicates	Description	Example
Perfect compound predicate	Formed with the perfect tense of the verb *sumus* and the participial form *victi*	"*Pugna magna* ***victi sumus***" (Liv. 22. 7. 8) – "We were defeated in a great battle"
Pluperfect compound predicate	expressed using the auxiliary verb *esse* in the pluperfect form	*Puellae laetae* ***erant*** – The girls had been happy
Future perfect (Futurum II) compound predicate	formed with *esse* in the future tense and a participle, conveying a future perfect meaning	"*Si* ***senserit*** *te timidum pater esse,* ***arbitrabitur*** *commeruisse culpam*" (Ter. Ph. 205) – "If the father realises you are a coward, he will consider it a fault"

Source: *compiled by the author*

According to A. Kuznietsova (2019), verbal forms of expression began to give way to nominal ones, with a noticeable trend toward nominalisation in both the lexical and syntactic systems of the language. In the examined texts, the compound nominal predicate (CNP) consists of a linking verb and a nominal part, which may be expressed by various parts of speech. When a noun forms part of the CNP, it expresses the identity or characteristic of the subject. When an adjective is part of the compound nominal predicates, it describes the quality or state of the subject. The linking verb in a compound nominal predicate is most frequently the verb *esse*, which varies in person, number, and tense. The typical structure of the CNP follows the pattern: *Subiectum* + *Verbum copulativum* + *Nomen praedicati*.

In the analysed material, the forms of expression of the compound nominal predicate (Table 3) vary. The nominal part of the CNP may be expressed by a noun in the nominative case – to indicate categories, qualities or professions; by an adjective in the nominative case – to characterise the subject; by a pronoun – to clarify or emphasise the subject; or by a participle – in complex constructions describing a state or action. In most cases, the compound nominal predicate consists of two components. For example, in the sentence "*Haecin meae sunt filiae?*" (Pl. Per. 1166) – "Are these my daughters?", the CNP consists of two parts: *sunt* – the third-person plural present tense form of the verb esse; and *meae filiae* – the nominal part of the predicate, comprising the noun *filiae* (daughters) in the nominative plural, serving as the subject, and the pronoun *meae* (my), which agrees with it in case, number and gender. The function of the CNP *sunt meae filiae* (they are my daughters) is to establish the identity or affiliation of the object. The predicate in the sentence structure ensures clarity and logical coherence: "*Amare, e quo nomen ductum amicitiae est*" – "To love, from which the name of friendship is derived", where *amare* (to love) gives rise to the word *amicitia* (friendship),

and the main verb *est* functions as the main sentence constituent in the compound nominal predicate. That is, the copula *est* functions as a logical link, indicating the existence of an action or quality, while the infinitive *amare* acts as the subject, although structurally it may be viewed as a separate element of the phrase explaining the origin of the word *amicitia*.

In a compound nominal predicate, both the logical subject of the construction and the nominal part of the predicate are placed in the accusative case: "*Laudem sapientiae statuo esse maximam*" (C. Fam. 5. 13. 1) – "I consider praise for wisdom to be the greatest (form of praise)". When the subject is a pronoun, it agrees with the nominal part of the predicate in gender and number: "*Haec mea culpa non est*" (Pl. Epid. 591) – "This is not my fault", where the CNP consists of the copula *est* with the negative particle non and the nominal component *mea culpa* (my fault). In a compound nominal predicate containing a nominal part, the copula often agrees not with the subject but with the nominal element itself: "*Unum erat omnia vulnus*" (Ov. Met. 15. 529) – "All was one single wound". In this example, the CNP is composed of the verb *erat* (was), which functions as the copula, and the nominal part *omnia vulnus*, which expresses the state or characteristic of the subject.

In addition to the copular verb *esse*, the predicate in the analysed texts is also represented by other verbs. For instance, in the sentence "*Claves portarum custodiamque murorum suae* ***potestatis fecit***" (Liv. 34. 21. 2) – "He took control of the gate keys and the guarding of the walls", the CNP is formed by the verb *fecit* (he took), which serves as the main verb indicating action, and the nounpredicate *potestatis* (control), specifying what exactly was taken under his authority. According to the lexicographic data presented by H. Petrova (2010), verbs such as *nominor*, *dicor*, *vocor*, *appellor*, *habeor*, *ducor*, *judicor*, *putor*, *existimor*, *numeror*, *creor*, *legor*, *eligor*, *renuntior*, *declaror*, *invenior*, and *reperior* can also take a nominal predicate in the *nominativus*.

In a compound nominal predicate, the linking verb *esse* functions as a copula combined with a predicative component in the form of a participle that expresses the subject's state, quality, or attribute. The predicate thus contributes to the semantic clarity of the sentence: "*Inimicus patriae fuisse Tiberius Gracchus a patriciis* ***existimatus est***" (Val. Max. 4. 7. 1) – "The patricians considered Tiberius Gracchus to have been an enemy of the fatherland", where the CNP is expressed through the past participle *existimatus* (considered), which provides a predicative characterisation of the subject *Tiberius Gracchus*, and *esse*, used as an auxiliary verb in forming the perfect construction. In the sentence "*Hasdrubal Carales* ***perventurus erat****, ni Manlius eum populatione continuisset*" (Liv. 23. 40. 8) – "Hasdrubal would have reached Carales, had Manlius not halted his advance", the CNP consists of the auxiliary verb *erat* (he was), which indicates the tense and modality of the action, and the nominal component perventurus – a future active participle (*participium futuri activi*), which refers to a prospective action of the subject.

Table 3. *Main forms of expressing the compound nominal predicates (CNP)*

Tense	Form of the verb esse	Example of a compound nominal predicate	Translation
Praesens	*sum, es, est, sumus, estis, sunt*	"*Populus* ***acer est****, suspicax, invidus potentiae*" (Nep. 13. 3. 5)	"The people are fierce, distrustful, and greedy for power"
Imperfectum	*eram, eras, erat, eramus, eratis, erant*	"*Principio rerum gentium nationumque* ***imperium*** *penes reges* ***erat***" (Just. 1. 1. 1)	"From the very beginning, power among peoples and nations belonged to kings"
Futurum I	*ero, eris, erit, erimus, eritis, erunt*	"*Qui prior strinxerit ferrum, ejus victoria erit*" (Sen. Ep. 95. 56)	"Whoever draws his sword first shall have the victory"

Source: *compiled by the author*

The simple verbal predicate and the compound nominal predicate share several similarities and differences. Firstly, a common feature is their role in defining the predicative part of a sentence. Both the simple verbal predicate and compound nominal predicates function as the main part of the clause, expressing the action or state of the subject. In both cases, the predicate is an essential component for conveying the meaning of the proposition. Secondly, both the simple verbal predicate and the compound nominal predicate agree with the subject in number and person. The differences between them include: 1) structure of the predicate – a simple verbal predicate consists of a single verb, which may appear in any tense, person, or number; a compound nominal predicate, by contrast, includes two components: a linking verb and a noun or adjective that expresses the state or characteristic of the subject; 2) meaning of the predicate – a simple verbal predicate conveys an action performed by the subject, while a compound nominal predicate expresses the subject's state or quality, typically by means of the linking verb esse, which connects the subject to a complementary element; 3) role of the verb – in a simple verbal predicate, the verb is the core element denoting an action or state. In a compound nominal predicate, the verb *esse* or another copular verb plays a supporting role, linking the subject to its attribute or condition.

Thus, in terms of structure, predicates in Latin are either simple or compound, while in terms of morphological realisation, they fall into three categories: simple verbal, compound verbal, and compound nominal predicates. All three types share a common feature – they define the subject's properties or actions – but they differ in structure and meaning: the simple verbal predicate focuses on action, whereas the compound nominal predicate emphasises the subject's state or attribute.

Conclusions

The study of the structural and semantic types of predicates in Latin constitutes an important aspect of linguistic analysis, as the predicate is one of the core components of a sentence's syntactic structure. Latin, as a classical Indo-European language, possesses a rich system of predicate forms, reflecting a wide range of meanings, functional roles, and structural characteristics. The predicate serves as a key means of expressing various grammatical and semantic nuances, including modality, tense, and aspectual features of an action, contributing to the depth and flexibility of Latin syntax. In the analysed texts, two principal forms of predicate expression are prevalent: the verbal predicate and the compound nominal predicate. Each of these forms has distinct features and patterns of usage within the sentence. The verbal predicate is formed using verbs that fulfil the function of the predicate and expresses the action or state of the subject. It is realised in two ways: as a simple verbal predicate – a verb in a specific tense (present, past, or future), in either the active or passive voice – and as a compound verbal predicate, which includes an auxiliary verb and the infinitive of the main verb. The compound verbal predicate is used to convey modality, intention, desire, or possibility, and may be further elaborated through the use of modal elements. These include modal verbs, infinitives with auxiliaries, modal adverbs, participles, and the subjunctive mood, all of which enable the expression of a wide range of modal nuances, such as possibility, necessity, desire, or probability.

The compound nominal predicate consists of a nominal part (a noun or an adjective) and an auxiliary copular verb, and it describes a property or characteristic of the subject. The position of the predicate in a sentence determines the logical structure of the statement and the interaction between its elements. In Classical Latin, the predicate is most frequently placed at the end of the sentence, which serves to emphasise the completeness of the thought and to highlight it as the key component of the utterance. In a sentence, the predicate may be represented either by a verb (particularly in a personal form)

or by various constructions that do not necessarily include a verb. Examining the different types of predicates in Latin has made it possible not only to gain a deeper understanding of the language's syntactic structure, but also to analyse features of Latin conceptual thought – especially its influence on the expression of modality, tense, and other grammatical categories. This study does not claim to provide an exhaustive account of the structural and semantic types of predicates in Latin. Nevertheless, it remains a relevant and important contribution not only to classical philology, but also to general linguistics, the history of languages, and interdisciplinary research. It therefore warrants further detailed investigation in future academic studies, particularly in the context of comparative analysis of the structural and semantic types of predicates in Latin, English, and Ukrainian.

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Структурно-семантичні типи присудків у латинській мові

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Анотація. У мовознавчій науці синтаксична теорія динамічно розвивається і помітно зростає інтерес науковців до питання дослідження синтаксичної будови латинської мови. Метою дослідження було проаналізувати структурно-семантичні типи присудків у семантико-синтаксичній структурі речення. У дослідженні застосовано комплексні методи дослідження – від морфологічного до контекстуального, поєднання якісного і кількісного аналізу. Систематизовано інформацію з різних джерел про присудок як окремий різновид головного члена речення, що має ряд специфічних ознак та описано параметри його функціонування. З'ясовано проблему синтаксичного зв'язку між членами речення – присудка як головного члена речення і другорядних членів речення, які разом формують структуру речення, виражають його основний зміст і визначають його специфіку. Проаналізовано позиційне розміщення присудка в реченнєвій структурі, з'ясовано його стилістичне навантаження, диференційні ознаки та форми вираження. Обґрунтовано, що присудок є семантико-граматичним ядром речення і за своєю структурою не однотипний. Розглянуто структурно-семантичні типи присудків у латинській мові, уточнено і систематизовано відомості про структурно-семантичні типи присудків, з'ясовано місце кожного різновиду в загальній типології присудків. Виявлено засоби ускладнення складеного дієслівного присудка модальними компонентами та обгрунтовано, що модальне значення, яке вносять засоби вираження до речення, залежить від морфологічного наповнення складеного дієслівного присудка, а також вибору дієслівних зв'язок. Зауважено, що при дієслівній основі складеного дієслівного присудка засоби вираження передають модальне значення відповідного предиката. Окреслено форми реалізації дієслівного присудка і складеного іменного присудка, виявлено особливості використання їх у реченнях та підтверджено прикладами. Проведене дослідження розширює уявлення про синтаксичну будову латинської мови. Результати дослідження структурно-семантичних типів присудків можуть бути використані у наступних наукових теоретичних розвідках щодо семантико-синтаксичної структури речення

Ключові слова: синтаксис; структура речення; предикативний зв'язок; присудок; простий дієслівний присудок; складений дієслівний присудок; складений іменний присудок

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Lexical and semantic features of the synonymic series of the key lexeme of the concept of freedom in modern English

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Abstract. The relevance of the study is determined by the increased attention of linguistics to the study of the concept of freedom in the value-semantic system of modern English, its active representation in political, cultural and social discourses, as well as the need for a comprehensive clarification of the semantic organisation and mechanisms of linguistic realisation of this concept, taking into account contextual variability and synonymic relations. The aim of the study was to analyse the synonymic series of the lexeme freedom as a key nominant of the linguistic and cultural concept of the same name. The research methodology included definitional, component, comparative, contextual and corpus analysis, which ensured the selection, description and classification of synonymic units, as well as the identification of their semantic and functional characteristics. The main lexical-semantic groups of synonyms for the lexeme freedom were established, covering political and civil rights, autonomy, freedom from coercion, privileges granted, freedom of choice and freedom of movement. Their dominant semes, typical collocations and stylistic parameters were analysed, which made it possible to clarify the conceptual component of the concept. A partial neutralisation of the semantic differences between freedom and liberty has been established in the political speeches of American presidents, where these lexemes mark fundamental democratic values. An analysis of the use of the lexemes freedom and liberty in speeches

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by American presidents showed that these terms acquired primarily philosophical, democratic and global significance, emphasising their role as fundamental values of the nation. The lexeme liberty was usually associated with constitutional rights, particularly in fixed combinations, emphasising the protection of specific freedoms. At the same time, freedom emphasised the universality and immutability of people's desire for autonomy, contrasting it with bondage and morally negative phenomena. Both lexemes were also used in a global context. Contextual synonyms (rights, opportunity, victory) that expand the semantic structure of the concept in discursive practice were analysed. The practical value of the study lay in the possibility of applying its results by specialists in cognitive linguistics, linguoculturology, political linguistics, as well as in the teaching of academic English and the analysis of political discourse

Keywords: linguo-cultural concept; synonymic range; lexical-semantic group; cognitive-discursive analysis; political rhetoric; lexical variability; discursive strategies

Introduction

As one of the key concepts of any linguistic culture, the concept of freedom has repeatedly been the subject of research within the cognitive and linguistic-cultural paradigms. In contemporary linguistic studies, the concept of freedom is considered multidimensionally – as a linguistic, axiological, cognitive and discursive phenomenon. A common feature of these studies is an emphasis on its value-based nature and its significance for national identity, as well as on its semantic diversity. The differences between the approaches of researchers are determined by the chosen research focus, which varies from etymology and symbolism to cognitive models and discursive representation of the concept of freedom.

A. Musolff's (2020) work systematised the mechanisms of conceptualising political concepts through scenarios and oppositions, which stimulated further research into the dynamics of value categories in political discourse. R. Wodak's (2021) study, devoted to the discursive strategies of identity politics and the ideological mechanisms of meaning formation, has significantly expanded the possibilities of critical discourse analysis, particularly with regard to concepts that can take on the characteristics of empty signs. Within the framework of contemporary applied and discourse-oriented studies, the concept of freedom is analysed as a functionally flexible formation capable of adapting to the communicative tasks of different types of texts. A. Shuhaiev & M. Malchenko (2022) showed that in PR discourse, freedom is objectified through positively marked lexemes and metaphorical models associated with choice, self-realisation and openness of opportunities, performing primarily manipulative and image-building functions, which leads to a pragmatic reorientation and semantic simplification of this concept. In the context of lexicology, the generally accepted position on the dominant element of a synonymic series remains important. Within the concept of freedom, this dominant element is the lexeme of the same name, which sets the main semantic vector in the structure of this concept. Etymologically, freedom comes from the Old English freodom, formed from freo "free" and the suffix -dom meaning "state," which attests to the ancient historical basis of the concept and its stability in the development of the English language system.

D. Sabadash & V. Lukaniuk (2023) analysed the peculiarities of the verbalisation of the concept of democracy in the speeches of world leaders in the context of the war in Ukraine and concluded that Joe Biden and Ursula von der

Leyen's speeches show the highest frequency of use of the lexeme democracy, while Boris Johnson's speeches are dominated by the verbalisers people and country, and Volodymyr Zelensky's speeches are dominated by the verbalisers free, freedom and people. J. Mathias & R.B. Silliman (2022) analysed the interaction between discourse on freedom of speech and hate speech, showing that freedom of speech is not absolute and needs to be balanced with the rights of others and democratic values. R. Soóky (2022) examined the political discourse of one party in Slovakia. The scholar demonstrated how language is used to construct ideas about freedom or lack thereof and how such discursive strategies reinforce ideological influence. In contemporary linguistic research, the study of linguocultural concepts takes into account their three-component structure, which includes conceptual, figurative, and value components. An important stage of the research is the description of the conceptual component of the concept, which is actualised in the direct nomination of the name-concept, as well as in the synonymic series of the key lexeme, the description of which contributes to the establishment of a complete set of conceptual features of the phenomenon under study. Despite a significant number of works devoted to this issue, the question of describing the synonymic series of the key lexeme of the concept of freedom in modern English remains unresolved.

The aim of the study was to analyse the synonymic series of the lexeme freedom in modern English as the nominant of the linguistic and cultural concept of freedom. The main objectives of the study were to carry out a definitional analysis of the lexemes included in the synonymic series of the lexeme freedom, followed by the identification of their common and distinctive semantic features between the selected lexical-semantic groups. In addition, an important task of the study was to conduct a contextual analysis of the functioning of these units in speeches and public appearances by American presidents over the past five years, namely 2020-2025, in order to establish the frequency of their use, determine the main collocation patterns, and establish semantic differences between individual synonyms in the spectrum of contextual meaning.

Materials and Methods

The subject of the study was lexical units selected from English-language thesauruses (Kipfer, 2022; Macmillan thesaurus, n.d.; Collins English thesaurus, n.d.) that formed a synonymic series for the lexeme freedom. This series included both core synonyms (liberty, independence, autonomy, self-determination, sovereignty) and units representing peripheral meanings, in particular those related to liberation (liberation, emancipation, release, discharge), granted rights or privileges (franchise, immunity, exemption, privilege), expanded opportunities for action (latitude, scope, room, leeway) and physical or functional freedom (freedom of movement, ease, facility). Refining the list made it possible to assess the representativeness of the sample and structure the semantic parameters of the series under study.

The work used an integrated approach to the analysis of the synonymic series of the lexeme freedom in modern English, combining the use of tools of lexical semantics, corpus linguistics and critical discourse analysis. At the first stage of the study, data from lexicographic sources necessary for the analysis of the definitions of the key lexeme freedom and lexical units included in its synonymic series were selected using the complete sampling method. Methods of definitional and component analysis were used to identify the core (archisemes) and peripheral (differential semes) meanings of lexemes included in the synonymic series of the lexeme freedom. The use of these methods is due to the need to identify the main lexical-semantic groups that contain a set of features reflecting the conceptual component of the concept of freedom in modern English. The

method of cognitive-discursive analysis served as a tool for describing the contextual meaning of the lexeme freedom and its synonymic series in the speeches of American presidents over the past five years. The contextual analysis of the nominative freedom through discursive practices is appropriate and methodologically justified, as it reveals the comprehensiveness of understanding and perception of the concept of freedom by native speakers of English. This method served as a tool for identifying the contextual meanings of the lexeme freedom as the dominant synonymic series and describing the semantic potential of other lexemes in this synonymic series, which made it possible to identify common and distinctive features between the selected lexical -semantic groups and to determine the differences in usage between individual synonyms in the spectrum of contextual meaning.

Corpus research methods were used in the study. The English Web 2020 corpus was used to search for corpus synonyms for the lexeme freedom in English. The Corpus of Contemporary American English (COCA) (n.d.) is hosted in the Sketch Engine corpus manager. Using the Thesaurus tool, a list of synonyms that can be included in the synonymic series of the lexeme freedom was obtained. The frequency and collocation patterns of lexical units in the synonymic series of the lexeme freedom in speeches and public addresses by American presidents were measured using the Voyant Tools (n.d.) web platform. In particular, it was found that the lexemes “freedom” and “liberty” are interchangeable synonyms used to denote the fundamental values of the American political and social system and denote the end result – a state where people are free and independent.

The lexicographic basis of the study was formed by the following sources: Longman collocations dictionary and thesaurus (2013), Oxford English Dictionary (n.d.), Merriam-Webster (n.d.), Online Etymology Dictionary (n.d.) and B.A. Kipfer (2022). The use of different types of dictionaries was necessitated by the need for a comprehensive analysis of the definitions, etymology and ideographic connections of the lexeme freedom. The main body of the material consisted of texts of political speeches and public addresses by American presidents, selected by means of a comprehensive sample from the online archive of The American Presidency Project (n.d.) for the period 2020-2025. The research also includes speeches and public addresses (spoken addresses and remarks) by American presidents Joe Biden and Donald Trump, selected by means of a complete sample from the online archive of the American Presidency Project for the last five years (The American Presidency Project, n.d.), which made it possible to study the use of the lexeme freedom in contemporary institutional discourse and to trace the realisation of its semantic potential in real communicative conditions. The research sequence included the formation of a research corpus, lexicographic analysis, semantic classification of units, corpus processing of the material, and generalisation of the observations obtained.

Results and Discussion

An important stage of the study is the description of the conceptual component, which is actualised both in the direct nomination of the name-concept and in the synonymic series of the key lexeme. The analysis of synonyms, associative fields and contextual uses allows to establish a complete set of conceptual features of the phenomenon under study, its cognitive and cultural significance. This emphasises that linguistic designation not only records knowledge about the world, but also shapes ideas about the social, historical and ethical priorities of a particular community. It has been proven that synonyms are grouped into a synonymic series around a dominant, which is the carrier of the basic meaning common to all lexical units of the entire synonymic series. The dominant of the synonymic series of the concept of freedom

is the lexeme freedom, which nominates this concept in modern English. The word freedom comes from the Old English freodom, which is derived from freo – "free" and the suffix dom "state, quality, condition". That is, in its original meaning, freedom meant "the state of being free". According to the Oxford English Dictionary (n.d.), the lexeme freedom has a long etymological and semantic history, reflecting its gradual development within the English language system. The dictionary records not only the date of the first appearance of this word, but also the successive changes in its meanings in different historical periods. In Old English, freedom was used mainly in the following meanings: 1) the state or fact of being free from servitude, constraint, inhibition, etc. 2) the state or fact of not being subject to despotic or autocratic control, or to a foreign power; civil liberty; independence. The dictionary also records the (figurative) meaning of the lexeme: Liberation from the bondage or dominating influence of sin, spiritual servitude, worldly ties, etc. In the 1860s, the lexeme freedom began to be used in the meaning "Exemption or release from the obligations of a contractual agreement; spec. release from a marriage, divorce".

The lexeme freedom is often defined through the use of the synonymous unit liberty. To understand how close these synonyms are in terms of semantic load, it is necessary to consider the etymology of the lexeme liberty. According to the Online Etymology Dictionary (n.d.), the noun liberty appeared in the English language at the end of the 14th century with the meaning "free choice, freedom to act according to one's own desires", as well as "freedom from the slavery of sin". The lexeme comes from the Old French liberte ("freedom, will"), attested in the 14th century (modern French liberté), which, in turn, originates from the Latin libertatem (nom. libertas) – "civil and political freedom; the state of a free person; absence of restrictions; permission". The root liber – "free" – is common to a number of lexemes, in particular liberal, and indicates the primary semantic component of "freedom" as the antithesis of subjugation or dependence. The primary use referred primarily to an individual, while the extension of the meaning to the community level, in the context of "freedom from arbitrary, despotic or autocratic power", was recorded at the end of the 15th century. At the same time, the dictionary material emphasises the difference between the French and English conceptualisation of freedom: in the French tradition, liberty is primarily associated with political equality, while in the English tradition it is associated with personal autonomy and individual independence.

According to the Oxford English (n.d.), the historical development of the lexeme freedom was accompanied by the emergence of a number of branch meanings that reflected social, legal and cultural changes in the English-speaking world. The dictionary notes that the nautical meaning of "leave" has been recorded since 1758, while the semantic line of "unrestricted action or expression", attested in the 1550s, became the basis for the formation of the idiom to take liberties – "to exceed the limits of what is permitted, to go beyond the bounds of decency" (1620s). Another meaning – "privileges granted" (14th century) – contributed to the establishment of legal and administrative semantics, which denoted "private land on which special privileges apply" (mid-15th century). In the 18th century, this semantic line developed into the meaning of administrative territories with their own jurisdictional rights in Britain and the United States, as reflected, in particular, in the toponym North Liberties of Philadelphia. The lexeme also formed a number of cultural and symbolic derivatives, including liberty-cap (1803) and liberty-pole (1775), which represented the idea of freedom during the American Revolution (Oxford English Dictionary, n.d.). Similar semantic phenomena are noted in Old French libertés – "local rights, laws, taxes", which indicates a historical

layering of meanings related to legal status and civil guarantees. That is, conceptually, liberty and freedom have similar Proto-Indo-European meanings: "to be free, not subject to or dependent on". However, these lexemes are not interchangeable and require contextual clarification of their use.

As a result of the definitional and component analysis of the lexeme freedom and lexical units included in its synonymic series, seven lexical-semantic groups (LSG) were identified, each of which reflects different aspects of the concept of freedom in modern English. Each LSG was formed by identifying core (archisemes) and peripheral (differential semes) characteristics, determining their semantic features, typical collocations, syntactic realisation and stylistic characteristics. The lexeme freedom is a polysemous lexical component of English, covering a semantic field ranging from state/legal rights to physical liberation and psychological feelings of freedom. LSG 1 includes synonymous units that correlate with freedom according to the dominant seme "political right" and covers the spectrum of political and legal principles of a person to act in accordance with their legal rights and political freedoms. This LSG covers such lexemes as liberty, franchise immunity, and exemption. All these units denote the right of an individual or community to act freely without legislative or political coercion, often institutionalised in the form of constitutional norms or declarations. Typical collocations are freedom of speech, freedom of religion, constitutional freedoms, and civil liberties. Such phrases are mainly used in constructions such as freedom of + N and have formal legal, academic or political connotations (Oxford English Dictionary, n.d.; Merriam-Webster, n.d.; Longman collocations dictionary and thesaurus, n.d.).

LSG 2 includes lexemes that contain the common archiseme "absence of physical or social restrictions". These include synonyms such as liberation, emancipation, release, and discharge. The common semantic features of these synonyms give reason to characterise freedom as a state of liberation from coercion, imprisonment or oppression. Collocations such as release from captivity, regain their freedom, emancipation from slavery demonstrate the connection between the lexical units of this group and the historical and social context, in particular the theme of slavery, which can be traced in the etymology of the lexeme freedom. In syntactic terms, characteristic combinations are to gain/regain freedom, freedom from + N. Stylistically, the group can be either neutral or historically and politically marked (Oxford English Dictionary, n.d.; Merriam-Webster, n.d.; Longman collocations dictionary and thesaurus, n.d.). LSG 3 includes lexemes that have the archiseme "autonomy" or "independence". These are lexemes such as: independence, autonomy, self-determination, self-government, sovereignty. Their common semantic feature is the right of a person to make their own decisions without any external control or influence from the state. Examples of typical collocations are: political independence, national sovereignty, university autonomy, self-government. Such units function as nouns described by the adjectives political, national, institutional and are characteristic of formal political and academic style (Oxford English Dictionary, n.d.; Merriam-Webster, n.d.; Longman collocations dictionary and thesaurus, n.d.). In this dimension, freedom also acts as a right of choice: free will, autonomy (as personal freedom). The semantics of these lexemes reflect freedom as the ability to act according to one's own choice. Typical collocations in this dimension are: freedom of the will, moral responsibility, choice. Characteristic syntactic constructions are: "freedom of will" or combinations with to have freedom to…. In this regard, the relevant contexts are philosophical, theological, and academic styles (Oxford English Dictionary, n.d.; Merriam-Webster, n.d.).

LSG 4 groups synonymous units under the archiseme "granted rights or privileges" and includes such lexemes as franchise, immunity, exemption, privilege, freedom of the city. These lexemes express the idea of officially granted freedom or exemption from certain obligations. The most common collocations are freedom of the city, diplomatic immunity, and apply for an exemption. They are realised in the constructions freedom of + NP or be given the freedom of + place. Stylistically, this group is associated with the official legal and ceremonial sphere (Oxford English Dictionary, n.d.). LSG 5 is grouped on the basis of the archiseme "possibility of action or range of choice". In this respect, the lexeme freedom functions in the meaning of freedom to do something. This LSG includes such lexemes as: latitude, scope, room, leeway. The semantic load of these lexemes allows to characterise freedom as the right to make decisions independently, to make choices for one's own benefit. These characteristics are revealed in such collocations: freedom to do something, give considerable latitude, scope for creativity, room for manoeuvre. Typical syntactic constructions are formed as follows: freedom to + V or freedom of + N (movement, choice). This group is used mainly in a neutral administrative, educational or creative context (Longman collocations dictionary and thesaurus, n.d.; Macmillan thesaurus, n.d.).

LSG 6 Contains synonyms that have a stylistic or informal connotation, expressing the meaning of openness, ease or violation of social norms (freedom in the sense of frankness, licence, boldness, ease). In this group, freedom can mean both a lack of restraint (speak with freedom) and excessive freedom that turns into impunity (freedom may degenerate into licence). Syntactically, constructions with the verbs speak, act + with/from freedom are used. The stylistic range varies from colloquial to journalistic (Merriam-Webster, n.d.). LSG 7 combines lexemes containing the archiseme "freedom of movement" and includes the lexemes freedom of movement, ease, facility. Its semantics describe the physical ability to move or use something without restrictions, as evidenced by the examples freedom of movement, freedom to move, and tracksuits designed to give freedom of movement. Typical syntactic structures are freedom of movement and give someone the freedom to + V. Stylistically, this group is neutral, used mainly in everyday, technical and descriptive contexts (Longman collocations dictionary and thesaurus, n.d.).

In contemporary linguistic studies of synonymy, there is considerable interest in shifting the focus of attention from the usual research plan to contextual and discursive analysis. The concept of freedom is one of the most ideologically charged concepts in philosophical and socio-political discourse, so its ontological essence is determined in the context of the specific discourse in which it functions. Using the Sketch Engine corpus research tool and the Thesaurus corpus research function, a list of words was compiled with an indication of their frequency and similarity rating, and a visualisation of contextually similar words was created in the form of a cloud (Fig. 1).

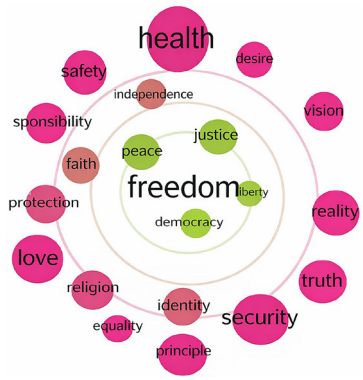

Figure 1. *Visualisation of the thesaurus for the word freedom*

Source: *created by the authors*

In the word cloud, the core is represented by the lemma of the given word freedom, and the lexemes grouped around it are words

that belong to the same semantic field or have a similar context of use. The frequency of use of a word affects its location in such a cloud. The higher the frequency, the closer the word is to the centre of the cloud. The results of the study showed that the closest to the centre of the cloud are direct synonyms and key political associates liberty and democracy, which demonstrate the high interchangeability of the lexemes freedom and liberty and indicate that freedom is a function of democratic influence and a necessary component for the existence of freedom. In the inner circle around the lexeme freedom are the key conceptual values justice and peace, which are not direct lexical synonyms but are integral components of the political context. The use of the lexeme justice indicates that in English, freedom is associated with justice, and the use of the lexeme peace indicates that freedom is either a condition or a result of peace. The largest bubbles on the outer circle visualise the dominant associations of freedom, and their size indicates a significant frequency of collocations or a high degree of association. These are concepts such as health security and love. This indicates such contextual features of freedom as "freedom of choice in the field of health", freedom as "national or personal security", and love of freedom as one of the basic human emotions. The outer circle contains conceptual units that define the boundaries and conditions of freedom, namely: responsibility, protection, safety, religion, faith, and independence. They are functional synonyms or conditions for freedom, and also emphasise the religious component (religious freedom) as a dimension of freedom.

A study of speeches and public addresses by American Presidents Joe Biden and Donald Trump, selected by a complete sampling method from the online data archive of the American Presidency Project for 2020-2025 (The American Presidency Project, n.d.) showed that the lexemes "freedom" and "liberty" are used as interchangeable synonyms to denote the fundamental values of the American political and social system. Their usage varies in the range from 0.0000 to 0.00035 (Y-axis) (Fig. 2).

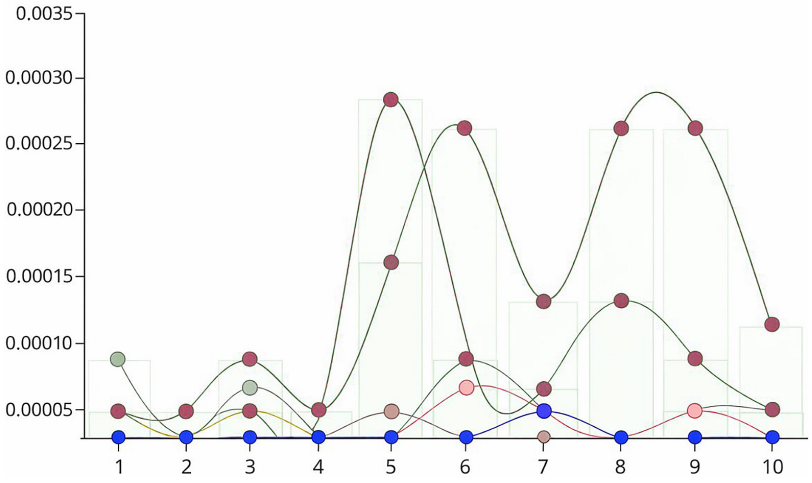

Figure 2. *Frequency of use of lexemes denoting the concept of FREEDOM in the studied corpus*
Source: *created by the authors*

Based on materials obtained from The American Presidency Project (n.d.), which includes speeches by Donald Trump and Joe Biden, an analysis was conducted of key lexemes and phrases that function as contextual synonyms for the concept of freedom. The study revealed

how different politicians implement the concept in discourse, highlighting both direct nominations (liberty, independence) and associative and metaphorical expressions that reveal the moral, democratic and global aspects of freedom. This approach ensured the systematisation of the semantic nuances of the lexeme freedom and its synonyms in contemporary US political discourse and made it possible to recreate the cultural and cognitive picture of the concept within the communicative practices of these politicians.

Analysing the differences in the use of the dominant lexemes freedom and liberty in the speeches of American presidents, it was concluded that in the speeches of President Joe Biden (American Presidency Project, n.d.), the lexemes freedom and liberty appear in more philosophical, democratic and global contexts, emphasising their role as cornerstones of the nation. Fundamental idea (Liberty): "Liberty" is the central concept on which the nation is based: as part of the fundamental inalienable rights: "the right to life, liberty, and the pursuit of happiness". "Liberty" is almost exclusively used in a combination that denotes specific constitutional protection: "religious liberty will be lost", "defend the right to life, religious liberty, free speech". The lexemes freedom and liberty are also used in moral and global contexts. Freedom emphasises the universality and timelessness of the human pursuit of freedom, underscoring its status as a fundamental value ("humankind's unending search for freedom") (American Presidency Project, n.d.) Liberty is used to describe the international role of the United States as a "beacon of liberty, democracy, and justice around the world". In addition, freedom is contrasted with morally negative phenomena, such as captivity, emphasising the value of choice and autonomy (Table 1).

Table 1. *Use of the lexemes freedom and liberty in Joe Biden's public speeches*

Synonymic unit	Number of occurrences (N)	Percentage, %	Typical context
freedom	19	51.4	Global, universal struggle against autocracy
liberty	17	45.9	Constitutional foundations, the "soul of America", historical heritage, religious freedom
liberation	1	2.7	The process of gaining freedom
TOTAL	**37**	**100.0**	

Source: *created by the authors based on The American Presidency Project (n.d.)*

In Donald Trump's speeches, the emphasis is placed on the threat of losing such values as freedom and liberty as a result of the actions of political opponents. The political threat is presented as follows: freedom is used in connection with a warning about political consequences: Democrats would allegedly turn America into "Venezuela without jobs, without welfare, without rights, without freedom" (Table 2).

Table 2. *Use of the lexemes freedom and liberty in Donald Trump's public speeches*

Synonymic unit	Number of occurrences (N)	Percentage, %	Typical context
freedom	14	58.3	The struggle to save the nation
liberty	10	41.7	Individual/religious rights that will be lost
liberation	0	0.0	-
TOTAL	**24**	**100.0**	

Source: *created by the authors based on The American Presidency Project (n.d)*

In the political speeches of contemporary American leaders, the lexeme freedom and its contextual synonyms are used in various semantic and communicative contexts. The lexeme liberty is the most direct synonym for freedom, but it has specific contextual nuances: in Joe Biden's speeches, it appears in classic constitutional formulations such as "the right to life, liberty, and the pursuit of happiness", where it reflects the fundamental rights of citizens; In Donald Trump's speeches, liberty is often combined with a religious context (religious liberty), denoting freedom protected from state interference. In the speeches of American presidents, the following contextual synonyms of the lexeme freedom are used: rights, opportunity, and victory. The use of the term contextual synonyms is due to the fact that the lexemes rights, opportunity, and victory in the analysed speeches of American presidents are not only associatively related to the concept of freedom, but also perform its functional semantic replacement in a specific discursive context. In the relevant fragments of political discourse, these lexemes represent separate semantic components of the concept of freedom (legal, socio-pragmatic, ideological), actualising the same value meanings and pragmatic functions as the dominant lexeme freedom. Thus, within a specific context, they perform a synonymous function at the level of discursive meaning, and not just an associative connection, since they can replace freedom without a significant loss of semantic load in the communicative structure of the utterance. The lexeme rights functions as the legal embodiment of freedom, defining the limits and guarantees of its realisation. In Joe Biden's speeches, it is interpreted as a means of ensuring personal autonomy and freedom of choice, particularly in the context of reproductive rights ("different approaches in different States to this issue… confuse people about their rights") (American Presidency Project, n.d.). Donald Trump mentions the right to life, religious freedom and freedom of speech in this series, emphasising specific forms of socio-legal realisation of freedom.

The lexeme opportunity acts as an economic and social reflection of freedom, emphasising positive freedom – the ability to act, develop and achieve goals. In Biden's speeches, this lexeme is combined with liberty in the phrase "the idea of liberty and opportunity for all", while Donald Trump uses it in antithesis to economic instability, which limits the freedom to prosper. The lexeme victory acts as a synonym for achieving freedom through struggle. In his speech at Arlington Cemetery, Biden notes: "…where liberty was tested and liberty prevailed", where victory emphasises the restoration of freedom. Contextual synonyms for the concept of freedom can also be represented by antonyms that denote a state of restriction of freedom. For example, Biden uses the phrase "the moral contest between captivity and freedom" (American Presidency Project, n.d.), where captivity is the opposite of freedom, and Trump refers to political concepts (socialism, communism, Marxism) that are associated with the absence of freedom in his rhetoric. Thus, the analysis of contextual synonyms demonstrates the multidimensionality of the concept of freedom in the political discourse of contemporary American leaders, which includes legal, moral, economic, and historical aspects of its implementation. The results obtained in the study made it possible to consider the concept of freedom as a multidimensional cognitive-semantic formation, structured through a system of lexical-semantic groups that reflected the legal, political, philosophical, social, and discursive dimensions of freedom. This approach was consistent with trends in contemporary cognitive linguistics, within which concepts were interpreted not as static units, but as dynamic semantic structures actualised in different types of discourse.

An analysis of the results of research on the works of foreign scholars from 2020 to 2025 led to the conclusion that the proposed classification

of lexical-semantic groups of synonyms for freedom was methodologically sound and consistent with current trends in global cognitive and discursive linguistics. Unlike a number of previous works, which focused mainly on individual aspects of freedom, the study demonstrated the integration of lexicographic, semantic and corpus approaches. A review of scientific works devoted to the concept of freedom reveals a variety of approaches to its interpretation and analysis, which is due to the interdisciplinary status of this concept. Within linguistic research, there has been a gradual transition from describing individual semantic meanings and dictionary definitions to a comprehensive understanding of freedom as a structured concept integrated into linguistic and cultural consciousness. Contemporary studies increasingly combine cognitive, discursive and corpus methods, which allows to identify the dynamics of meanings, pragmatic shifts and axiological components of the lexeme freedom in different types of texts. This research context provides a basis for a systematic analysis of previous scientific developments and the identification of those aspects of the semantic organisation of the concept that require further clarification.

I. Holubovska (2004) characterised the concept of freedom through the prism of national and cultural meanings, emphasising its value-based nature and role in shaping the identity of language speakers. The researcher emphasised the symbolic and axiological dimensions of freedom, which determine its special status in the linguistic consciousness of Ukrainians. The researcher concluded that the concept of freedom is a value constant that shapes the cultural identity of language speakers. Ukrainian linguist V. Zhaivoronok (2006) applied a comprehensive approach to the analysis of linguistic units of the concept of freedom through the prism of etymological, cultural and symbolic approaches. The linguist considered freedom not only as a linguistic or philosophical concept, but as a cultural archetype deeply rooted in the worldview of Ukrainians. The author noted that in traditional culture, freedom is associated with naturalness, will, earth, movement, life – that is, with spheres that reflect the harmony between man and the world and represent the value centre of the Ukrainian mentality, combining individual and collective identity. Exploring the concepts of will, freedom, dignity, law, and struggle in the context of Ukrainian linguistic culture, V. Kononenko (2008) also emphasised their value and worldview interconnection. The scholar concluded that these concepts form the mental and semantic core of Ukrainian national consciousness, as they express the ideals of independence, justice, and self-respect. According to the author, the concept of freedom in the linguistic picture of the world cannot be considered in isolation, as it is closely linked to the concept of will as a spiritual and moral category, as well as to dignity and rights as social manifestations of freedom.

Further development of research on the concept of freedom demonstrates the expansion of the thematic and methodological framework of its analysis. In particular, T. Pechonchyk (2009) focused on studying the concept of freedom of speech in contemporary Ukrainian mass media discourse. The researcher analysed the mechanisms of its verbalisation, identifying the key lexical and semantic means of representing freedom of speech, and traced the ideological and axiological guidelines that determine the functioning of this concept in media texts. The author argues that freedom of speech appears not only as a legal category, but also as a discursive construct closely linked to political, social and cultural factors. T.A. van Dijk (2006) investigated how political ideologies are formed and maintained through discourse. The author analysed how language not only reflects political views but also actively constructs social realities, influencing people's perceptions of events and behaviour. The study showed that politicians and the media use

linguistic strategies to legitimise power, create "us" and "them" and reinforce existing social structures. The conclusions indicated that discourse has always been an instrument of ideological influence rather than a neutral description of reality. N. Nagy (2016) analysed freedom of speech, considering it as a social, legal and cultural phenomenon. The author examined how different societies defined the limits of freedom of speech and what factors restricted or protected it. The study showed that freedom of speech has always been conditional, contextual and dependent on political and legal structures. The researcher concluded that the concept of freedom of speech cannot be considered an absolute value: its implementation is always intertwined with social norms, power interests and historical circumstances.

Ukrainian researcher N. Yesypenko (2010) described the concept of freedom as a culturally conditioned mental construct that reflects the values, mentality and historical experience of the English people. The author concluded that the concept of freedom has a complex multi-level structure that changes depending on the cultural context and era, and is represented through a series of cognitive segments, such as independence, carefreeness, freedom of movement, free life, etc. In modern English, this concept is closely linked to the national mentality of the English, their love of freedom, individualism and desire for personal dignity. In artistic discourse, according to S. Lushchii (2024), freedom acquires existential and ideological content, being interpreted in the prose of Ukrainian writers of the diaspora through the prism of historical trauma, loss of homeland and search for identity, which gives it the features of moral choice and spiritual self-affirmation. The political dimension of the concept of freedom is revealed in the study by M. Pylynskyi (2024), where freedom in the poetic texts of Pavlo Vyshebaba appears as a category of civic responsibility, resistance and struggle, closely linked to the national identity and military experience of modern Ukraine. A generalisation of these approaches shows that the semantic structure of the concept of freedom is significantly modified depending on the discursive context, actualising various value, pragmatic and emotional-expressive components. A comparative linguocultural approach is also presented in the study by R. Karakevych & O. Radchenko (2025), which differentiates between the concepts of will and freedom in Ukrainian and German linguocultures, revealing the specifics of their value dominants, semantic accents, and culturally conditioned models of conceptualising freedom.

N. Fairclough (2013) developed a methodology of critical discourse analysis aimed at systematically investigating how language constructs power, ideology and social relations. The author examined various texts and discursive practices, demonstrating that language analysis allowed the hidden mechanisms of social control and ideological influence to be revealed. The study showed that discourse has never been neutral, but rather an instrument for shaping social reality, and that critical analysis helped to understand the relationship between language, power and culture. I. Orazbekova (2025) conducted a cross-cultural associative study of the concepts of "education", "freedom" and "happiness", involving participants from different cultural contexts. The author analysed the associations that these concepts evoked in people and compared them across countries. The study showed that cultural contexts significantly influenced how people perceived freedom, education and happiness, and that these concepts had different value and emotional connotations. The author concluded that there were no universal ideas about these key social values and that their perception was deeply rooted in cultural traditions and social practices. The concept of freedom is actively researched in the field of political discourse, where it is realised through historical narratives, political slogans, literary motifs,

religious concepts, legal texts and folkloric images. It is embedded in the collective memory of society, reflecting the historical experience of the struggle for independence, human dignity and social rights. T. Nikishyna (2016) studied the linguistic means of verbalising the concept of freedom in Ukrainian, French and English linguocultures. The researcher noted the complex semantic structure of the lexemes that verbalise this concept and the diversity of its discursive realisations (political, philosophical, artistic discourses).

Conclusions

The lexeme freedom forms a multidimensional synonymic series that includes legal/political meanings, meanings related to liberation, autonomy, privileges granted, as well as utilitarian meanings (freedom of movement, ability to act). The identified lexical-semantic groups of synonyms, their semantic features, and typical collocations allow to highlight the main conceptual features of the concept of freedom, such as: political right; freedom of choice; autonomy; academic freedom; exemption from duties, granting immunity, privileges; freedom of movement, relocation. The lexeme freedom is a polysemous lexical component of English, covering a semantic field ranging from state/legal rights to physical liberation and the psychological feeling of being free. Analysis of the synonymic series allows to identify the core meanings and peripheral semantic variations, which is important for linguistic research, translation and teaching academic vocabulary.

An analysis of the functioning of synonyms included in the synonymic series of the lexeme freedom showed that the most frequent in speeches and spoken addresses of American presidents is the dominant lexeme of the synonymic series freedom, which functions alongside the lexeme liberty, which, when realised in different communicative planes, express the main characteristics of freedom as a key concept of American linguistic culture. A discursive analysis of the speeches of American presidents Joe Biden and Donald Trump showed that freedom and liberty, although close in their basic meaning, perform different pragmatic and ideological functions. In Biden's speeches, the lexeme freedom mostly emphasises civil rights, social values and community interests, reflecting the pragmatic frame of democratic solidarity. Liberty in his discourse has a more formal, political and legal context related to individual freedoms and constitutional guarantees. In Trump's speeches, freedom is often used as a symbol of the struggle against external control and state restrictions, while liberty emphasises the rhetorical aspect of individual autonomy and economic freedom. These differences demonstrate that the semantic core of the concept of freedom is realised through various discursive and pragmatic modules that reinforce the speaker's ideological attitudes. In the perspective of further research, it would be useful to analyse the synonymic range of the lexeme freedom in the discursive practices of American, British and Ukrainian politicians and to consider the contextual differences in their use of the word in political discourse.

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Лексико-семантичні особливості синонімічного ряду ключової лексеми концепту freedom у сучасній англійській мові

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Анотація. Актуальність дослідження зумовлена посиленою увагою лінгвістики до вивчення концепту freedom у ціннісно-семантичній системі сучасної англійської мови, його активною репрезентацією в політичному, культурному та соціальному дискурсах, а також необхідністю комплексного уточнення семантичної організації й механізмів мовної реалізації цього концепту з урахуванням контекстуальної варіативності та синонімічних зв’язків. Метою дослідження був аналіз синонімічного ряду лексеми freedom як ключового номінанта однойменного лінгвокультурного концепту. Методологія дослідження охоплювала дефініційний, компонентний, порівняльний, контекстуальний та корпусний аналіз, що забезпечило добір, опис і класифікацію синонімічних одиниць, а також виявлення їх семантичних і функціональних характеристик. Встановлено основні лексико-семантичні групи синонімів лексеми freedom, що охоплюють політичні й громадянські права, автономію, звільнення від примусу, надані привілеї, свободу вибору та свободу руху. Проаналізовано їхні домінантні семи, типові колокації та стильові параметри, що дозволило уточнити понятєвий складник концепту. Встановлено часткову нейтралізацію семантичних відмінностей між freedom і liberty у політичних промовах американських президентів, де ці лексеми маркують засадничі демократичні цінності. Аналіз використання лексем freedom та liberty у промовах американських президентів показав, що ці терміни набували насамперед філософського, демократичного та глобального значення, підкреслюючи їхню роль як фундаментальних цінностей нації. Лексема liberty зазвичай пов’язувалася з конституційними правами, зокрема у сталих поєднаннях, акцентуючи на захисті конкретних свобод. Водночас freedom підкреслювала універсальність і незмінність прагнення людей до автономії, протиставляючись неволі та морально негативним явищам. Обидві лексеми також використовувалися у глобальному контексті. Проаналізовано контекстуальні синоніми (rights, opportunity, victory) що розширюють смислову структуру концепту в дискурсивній практиці. Практична цінність дослідження полягала у можливості застосування його результатів фахівцями з когнітивної лінгвістики, лінгвокультурології, політичної лінгвістики, а також у навчанні академічної англійської мови та аналізі політичного дискурсу

Ключові слова: лінгвокультурний концепт; синонімія; лексико-семантичний клас; когнітивно-дискурсивний аналіз; політична риторика; лексична варіативність; дискурсивні стратегії

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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 сітьового покриву 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 "Ekspozytsiia"], 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» [pokryvaietsia 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 «Гізмо 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 kliuchkadr] 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 zsuv 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» [zsuv 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 покриву» [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

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Linguistic representation of the category of "object" in English biotechnology terminology

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Abstract. The relevance of this article is determined by the need to examine how the category of "object" is represented in English biotechnology terminology. The aim of the study was to identify the subcategories of the concept of "object" that find their lexical expression, as well as to investigate the linguistic mechanisms – particularly morphological and syntactic structures – used to denote them. To achieve this aim, a set of selective, analytical, morphological, structural-semantic, classificatory, systemic, and statistical methods was employed. It was found that within the English biotechnology terminological system, the category of "object" comprises four main subcategories: biological (36.5%), chemical (23.8%), technological (21.0%) objects, as well as materials and products (18.7%). Both simple and compound structures are employed to represent the category of "object" linguistically in English biotechnology terminology. Biological objects are predominantly expressed by simple nouns, whereas technological objects, materials, and products are more frequently represented by compound phrases. Chemical objects exhibit an almost equal distribution between simple and compound forms. Overall, the majority of terms are nouns, which is consistent with the norms of scientific and technical terminology. The obtained results confirmed the findings of modern studies regarding the dominance of nominal structures and the

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tendency to use compound names in biotechnology terminology, which is driven by the need for precision and systematicity in professional nomination. The practical significance of the study lies in the potential application of its results in teaching English for Specific Purposes to students majoring in Biotechnology and Bioengineering

Keywords: categorisation; subcategories; nominal structures; phrases; lexical expression

Introduction

The relevance of the article lies in the need to study the object categorisation in the formation, structuring, and functioning of English biotechnology terminology, which requires a systematic analysis of linguistic means representing the object category. The study of the processes of categorisation of natural objects and phenomena, as well as how they are represented in language, is a key issue in cognitive semantics. Categorisation serves as a fundamental cognitive mechanism that ensures the organisation of knowledge about objects, phenomena, and events of reality. Its linguistic representation reflects the specificity of human thinking, as well as cultural and social factors, and the cognitive processes underlying the formation of concepts. Linguists have long investigated the terminology of various scientific fields using diverse approaches. The issue of linguistic categorisation of terminology, which attracts interest not only from linguists but also from the broader scientific community, is increasingly becoming a subject of scholarly research. Within language, researchers classify scientific concepts into categories based on specific characteristics. This classification is grounded in the existence of conceptual types within each terminological system, which determines the organisation and distribution of core terminology within a given field of knowledge. Scientific concepts, as expressed through linguistic means, are categorised according to shared and distinctive features.

The relevance of researching the problem of categorisation in various scientific fields is confirmed by a large number of linguistic studies dedicated to this issue. For example, M.X. Dalieva (2023) investigated the processes of conceptualisation and categorisation in English-language terminology. The study emphasised the cognitive and linguistic aspects of term formation and systematisation, illustrating how categories were constructed within terminological systems. The author highlighted the role of prototypical concepts in organising knowledge and demonstrated the interrelation between cognitive structures and their linguistic representation. The work provided a theoretical framework for understanding how scientific terms reflected underlying conceptual categories and offered guidance for further research on terminology development in specialised domains. Although the article reported a high proportion of neologisms in the lexicon of specialised domains (>90%), it remains unclear which corpora or datasets supported this claim, and no specific examples were provided. Overall, the article is largely theoretical; incorporating practical empirical research, such as an analysis of a specific terminological field, would have strengthened the argumentation.

O. Syrotina & V. Lashkul (2023) focused their attention on conceptual categories represented by English terms in the food industry. The study constituted a valuable theoretical and terminological contribution, providing a systematic understanding of food industry terminology from the perspective of conceptual categories. At the same time, it was primarily oriented toward descriptive classification rather than an in-depth empirical investigation of the specific mechanisms of term formation

and functioning. Although quantitative data were provided (eight categories, with respective percentages), it would have been desirable to include more examples of terms from each category, along with their linguistic analysis, including morphology, word formation, and the interrelations between categories.

The study by T.V. Stasyuk (2020) examined how primary conceptual categories are represented in the terminology sphere of modern technologies. The author analysed mechanisms of term formation, systematisation, and classification, emphasising the interrelation between cognitive structures and linguistic forms, and further explored the cognitive and sociolinguistic factors that influence the emergence and evolution of specialised terminology, providing a comprehensive framework for understanding categorisation in high-tech domains. Similarly, the research by I. Voloshchuk & O. Mukhanova (2021) focused on term formation and conceptual categorisation in healthcare, highlighting the role of cognitive structures and frame-semantic modelling. The researchers concluded that categorisation organised medical knowledge by defining phenomena, objects, symptoms, and their interrelations. Although the study provided a strong theoretical foundation, empirical analysis was limited, with few examples of terms or word-formation patterns. Nonetheless, it offered valuable insights into conceptual organisation and terminological structuring in specialised fields.

In a more recent contribution, H. Whitaker & E. Hawthorne (2025) examined the conceptualisation of the category "property" in English food industry terminology, focusing on the linguistic representation of qualitative and quantitative characteristics of products. The authors applied cognitive and corpus-linguistic approaches to reveal how the property concept functions as a core semantic and categorising element in terminological structures. They demonstrated that adjectives, compound nouns, and attributive constructions play a crucial role in shaping domain-specific categories. The study's integration of empirical examples and corpus evidence makes it a strong complement to earlier, more theoretical works, contributing both to terminological linguistics and applied lexicography. According to M. Taubaldiyev *et al*. (2024), the broader issue of terminology organisation was addressed. The authors analysed the challenges of unifying and stabilising general scientific terminology, emphasising the need for methodological approaches for categorisation and systematisation. The paper reviewed linguistic, cognitive, and interdisciplinary approaches to the structure of scientific terms and highlighted the need for standardisation to ensure terminological consistency across disciplines. Although primarily theoretical, this work contributes to the broader understanding of how categorisation underpins terminological coherence and interdisciplinary communication.

Existing studies mainly focused on general term categories, while certain categories, in particular "object," remain insufficiently explored, which justifies the need for their detailed analysis. In biotechnology terminology, the category "object" requires further investigation due to its semantic ambiguity: it can refer to cells, genes, proteins, or experimental materials, which complicates understanding and translation. Analysing the linguistic representation of this category makes it possible to identify the cognitive structure of terms and ensures standardisation and accuracy in the development of glossaries, educational materials, and scientific publications.

The purpose of this article was to study the linguistic means used to verbalise the category of "object" in English biotechnology terminology. To achieve this aim, the following research objectives were set: to identify the terms denoting the category of "object" and group them into four conceptual subcategories; to characterise the linguistic means employed to represent the category of "object" in

English biotechnology terminology; to analyse the structural and semantic characteristics of the terms representing this category in biotechnological discourse.

Materials and Methods

The terminological data were also taken from specialised dictionaries such as A. Zaid *et al*. (1999) and N. Kimball (2002). Other reference sources included A. Slater *et al*. (2008), Encyclopaedia of Biotechnology (n.d.), G. Miglani *et al*. (2025). General reference dictionaries such as the Britannica Dictionary (n.d.), and Collins (n.d.) were also used to clarify meanings and usage.

The sample of 400 terminological units was compiled through expert sampling. Initially, terms were identified across the designated sources, after which only those fulfilling predefined inclusion criteria were retained. The criteria comprised: demonstrable relevance to biotechnology as a scientific and applied discipline; classification within the semantic category of "object"; and alignment with one of the examined morphological patterns. Terms that were overly general, context-dependent, lacking direct relevance to biotechnology, or duplicated across sources were excluded. This systematic, stepwise selection procedure ensured the construction of a representative and thematically coherent sample, suitable for rigorous linguistic analysis. To achieve the research aim, a combination of methods was employed in a structured and sequential manner. At the first stage, a selective method was applied, involving the identification and collection of linguistic material from various sources, including the dictionaries and reference works mentioned above. Attention was focused on selecting terms related to the category of "object" that were represented by various morphological patterns, providing a broad sample for comprehensive analysis of the linguistic material. At the second stage, an analytical approach was implemented, entailing a multi-level examination of English biotechnology terms to identify and classify the linguistic means used to represent the category of "object". The terms identified through the analytical approach were systematised and grouped into four conceptual subcategories: Biological Objects**,** Chemical Objects, Technological Objects**,** and Materials and Products.

The classification of terms into Biological Objects, Chemical Objects, Technological Objects, and Materials and Products was based on specific semantic and functional criteria. Biological Objects include terms that denote living organisms or their parts, such as cells, tissues, organs, and organelles, as well as microorganisms and viruses that participate in life processes. Terms were assigned to this category if their primary characteristic is the biological or living nature of the entity. Chemical Objects comprise terms referring to molecules, chemical compounds, metabolites, enzymes, hormones, and other substances involved in biotechnological processes. A term was included in this category if it represents an entity with a defined chemical structure or a biochemical function. Technological Objects cover terms denoting instruments, equipment, methods, and technological means used in biotechnology. Terms were placed in this category if their main characteristic is technological or engineering purpose, facilitating experimentation, manipulation, or production. Materials and Products include terms referring to raw materials, biomaterials, modified organisms, and biotechnological products. A term was assigned to this category if its primary role is as an input or output within a biotechnological process. Each term was categorised based on its predominant semantic and functional features to ensure consistency and mutual exclusivity among the subcategories.

The classification of terms denoting the category of "object" in English biotechnology terminology is based on four key criteria – ontological, functional, epistemological, and pragmatic**.** According to the ontological criterion, objects are differentiated by their

nature of existence: Biological Objects represent living organisms or tissues (cell, bacterium, plant tissue), while Chemical Objects denote biomolecules and reagents involved in bioprocesses (enzyme, protein, substrate). The functional criterion defines the role of these entities in biotechnological processes – as active agents, substrates, instruments, or products. The epistemological criterion reflects the level of conceptual abstraction, distinguishing between natural scientific entities (Biological and Chemical Objects) and applied or engineered constructs (Technological Objects, Materials and Products). Finally, the pragmatic criterion considers their purpose and practical relevance: Technological Objects serve as tools for experimentation and production, whereas Materials and Products embody the tangible outcomes of biotechnological innovation, such as biofuel or pharmaceutical compounds. At the third stage of the study, the linguistic means representing the category of "object" were systematically characterised. The morphological method was employed to determine the part of speech of each term component, establish the morphological structure, and classify terms according to typical patterns that reflect their internal grammatical and semantic organisation. Structural-semantic analysis was applied to identify word-formation patterns within each conceptual subcategory. Additionally, classification, quantitative analysis, and both systemic and statistical methods were used to assess the quantitative distribution of linguistic means representing the category of "object". The fourth stage was devoted to summarising and comparing the research findings, which involved the application of a systemic method to integrate and interpret the results.

Results and Discussion

A prominent theoretical perspective emphasised the central role of the object within cognitive and conceptual frameworks, providing a basis for understanding its significance in specialised fields such as biotechnology. G. Lakoff (1987) emphasised the significance of the object as a fundamental component in the conceptual structuring of events and cognitive representations. Similarly, according to the cognitive model of the world proposed by R.W. Langacker (1991), the object occupied a central position within the event participant schema, which consisted of the agent, process, and object. Biotechnology, as an applied interdisciplinary field, primarily deals with material and concrete entities such as cells, genes, proteins, enzymes, tissue cultures, vectors, nanoparticles, and biomaterials, which determines the object-oriented nature of its terminological system. In most quantitative studies the "object" category accounts for the largest proportion of terms in technical and natural sciences – up to 40-60% of the system – due to the continuous emergence of new material entities and their corresponding terms.

In the Britannica Dictionary (n.d.), an object is defined as "something that is a visible entity, something that can be perceived by the senses". Similarly, the Collins (n.d.) defines an object as "anything that has a fixed shape or form, that you can touch or see, and that is not alive". In everyday language, the term "object" is often used to refer to inanimate things. However, in specialised fields such as biotechnology, the category of "object" may also include living organisms, when they are considered as subjects of study, experimentation, or classification. Modern cognitive science offers new perspectives on the concept of "object" from psychological, philosophical, and linguistic viewpoints. Cognitive psychology, in particular, investigates how humans mentally represent and process objects. It examines the ways in which the brain categorises and recognises objects, focusing on concepts such as object permanence – the understanding that objects continue to exist even when not directly

observed – and mental representation. Research on visual perception and attention further reveals how objects in the environment were processed, identifying features such as shape, colour, and size in order to recognise and interact with them effectively.

The concept of "object" can be examined from multiple disciplinary perspectives, each providing unique insights into its nature and role. In philosophy, it is approached through metaphysical, epistemological, and phenomenological lenses. For instance, the principle of linguistic relativity suggests that the language spoken influences how one's perception and think about the world. Cognitive linguistics, which intersects with cognitive science, examines how conceptual metaphors and mental schemas affect the ways language is used to describe objects and actions. From a metaphysical perspective, philosophers debate the nature of objects, examining the relationship between an object and its properties and the conditions of its existence. Epistemologically, attention is given to the processes through which objects are known and to the ways in which sensory experience and cognitive mechanisms shape their perception. Linguistics contributes an additional dimension by analysing how language structures and classifies objects. The terminology and descriptive frameworks applied to objects play a significant role in shaping their conceptualisation. From a metaphysical perspective, philosophers debate the nature of objects, examining the relationship between an object and its properties and the conditions of its existence. Epistemologically, attention is given to the processes through which objects are known and to the ways in which sensory experience and cognitive mechanisms shape their perception. Linguistics contributes an additional dimension by analysing how language structures and classifies objects. The terminology and descriptive frameworks applied to objects play a significant role in shaping their conceptualisation.

The issue of categorisation processes and their linguistic representation has been thoroughly examined in numerous studies by cognitive linguists. G. Lakoff (1993) highlighted the influence of conceptual metaphors on thought and language. B. Ross (1997) showed the impact of categorisation on classification processes in experimental studies. Universal human concepts and culture-specific categories in cognitive representation were emphasised by A. Wierzbicka (1992). J. Taylor (2003) explored the structure of categories and the role of prototypes in linguistic categorisation. E. Rosch & B. Lloyd (1978) examined the processes of human cognition and the ways in which people categorise objects and concepts, exploring how mental categories are formed, structured, and used to organise knowledge. The interaction between syntax, semantics, and cognitive representation was demonstrated by B. Rudzka-Ostyn (1988). Their research covered various dimensions of categorisation and conceptual representation in language, forming a strong theoretical basis for further investigation. These approaches were systematically summarised in the book of H. Cohen & C. Lefebvre (2017), where categorisation is defined as "the basic cognitive process of organising objects into categories", and a category is described as "a set of objects, ideas, or events grouped together based on shared features or properties". It was emphasised in the book that categories are not merely linguistic labels, but cognitive structures that reflect the ways in which humans perceive, organise, and interpret the world. From this perspective, in terminological systems, particularly in scientific and technical terminology, categories function as conceptual frameworks that group terms according to shared characteristics, while the process of categorisation serves as a mechanism for organising, structuring, and interrelating terms within a coherent conceptual system. This cognitive-linguistic approach provides a solid foundation for analysing the internal structure of specialised terminologies.

In the context of biotechnology, the category of "object" refers to a defined group of items, entities, or materials that share common features, functions, or characteristics and are studied, developed, or utilised within biotechnological applications. These categories often correspond to the biological, chemical, or technological components fundamental to biotechnology. In this field, the category of "object" typically includes biological entities, such as living organisms like cells, bacteria, or plants, as well as biological systems that are studied, manipulated, or engineered. It also encompasses materials and products, including raw materials used in biotechnological processes, such as enzymes, biomolecules, or substrates, as well as final products like pharmaceuticals, biofuels, or genetically modified organisms. Technological tools and equipment, such as instruments, devices, and bioreactors employed in research, experimentation, or production processes, are also considered objects. Finally, research targets, including specific genes, proteins, or metabolic pathways that are the focus of study or engineering, fall within this category.

H. Syrotina (2022) examined the conceptual categories expressed in English biotechnology terminology, focusing on their structure and frequency. In this study, the category of "object" was identified as one of the key categories, primarily including biological entities – cells, bacteria, plants, biomaterials, and other organisms that serve as the main objects of scientific research and technological processes. The author emphasised that terms denoting objects provide the structural basis of the terminology system and serve as a foundation for forming other categories, such as processes or methods. However, technological tools, materials, and final products were not considered part of the "object" category, and the functional role of this category in methodology or communication was not specifically addressed, making the approach somewhat framework-based and limited. Thus, the "object" category in the work of H. Syrotina (2022) was shown to represent the primary cognitive and conceptual foundation of biotechnology terminology, but without the detailed elaboration provided by a more comprehensive classification. In biotechnology, the category of "object" can be understood as a system for grouping entities – biological, chemical, and technological – based on shared characteristics. This classification supports the effective organisation, analysis, and practical application of knowledge in both biological research and industrial processes. Within biotechnology terminology, the "object" category encompasses terms that designate biological objects, label chemical objects, mark technological objects, and indicate materials or products. Table 1 presents the classification of the "object" category in English biotechnology terminology.

Table 1. *Classification of the "object" category in English biotechnology terminology*

Category of object	Definition	Number of terms	Percentage (%)
Biological objects	Living organisms or biological systems studied or used in biotechnology	146	36.5
Chemical objects	Biomolecules, reagents, or chemical substances involved in biotechnological processes	95	23.8
Technological objects	Instruments, equipment, or devices used in research or production	84	21.0
Materials and products	Raw materials, intermediates, or final products applied or obtained in biotechnology	75	18.7
Total	-	400	100.0

Source: *created by the authors*

Table 1 illustrates the classification of the "object" category within English biotechnology terminology, encompassing four principal subcategories: biological, chemical, and technological objects, as well as materials and products. Biological objects account for the largest share of terms (36.5%), which can be explained by their fundamental role in biotechnological research and experiments, where they serve as the basis for generating new knowledge and technologies. The high frequency of these terms is also due to the fact that they are predominantly expressed as simple nouns, which are easier to incorporate into scientific texts and dictionaries. In contrast, materials and products are less represented (18.7%) because they are mainly the end results of technological processes and often require complex or specialised word combinations, which limits their frequent use and prevalence in the terminological corpus. Chemical objects account for 23.8%, emphasising the importance of biomolecules and reagents in biotechnological processes. Technological objects represent 21.0% and reflect the technical aspect of the field related to the use of instruments and equipment. Overall, the table demonstrates a balanced structure of the terminology system, with a dominant focus on the biological component.

The first subcategory under consideration was "biological object". Terms in this category are among the most representative, accounting for 146 entries, or 36.5% of the total sample. This group includes living organisms, as well as their parts, molecules, and other components that play a crucial role in biological processes and biotechnological applications. Examples: cell, bacterium, yeast, plant, animal, tissue, organelle, virus, algae, fungus, spore, embryo, microbe, prokaryote, eukaryote, nucleus, cilium, pathogen, symbiont, parasite, microalga, mycelium, prion. Linguistic Representation of the terms in this subcategory is that they are often expressed through direct nouns, which serve to clearly and unambiguously denote specific biological entities. These nouns can be simple nouns, single-word terms that represent fundamental biological units or components (cell, bacterium) or complex nouns: combinations of two or more words that specify complex entities or structures (mitochondrion, bacteriophage). Word combinations frequently used in this subcategory: cell membrane, stem cell, bacterial culture, viral particle, tissue sample. These combinations are widely employed to specify biological objects more precisely and are commonly found in English biotechnology terminology.

Noun + Noun phrases are often used to denote complex or specific biological objects, where the first word defines the category or type, and the second specifies the particular element or function. Examples include: stem cell, plant cell, cell membrane, tissue sample (Zaid *et al.*, 1999). Adjective + Noun phrases describe the properties, type, or origin of an object. For example: bacterial culture – a collection of bacteria grown under laboratory conditions; viral particle – an individual virus unit (virion) capable of infecting host cells; microbial strain – a genetically distinct variant of a microorganism within a species. Participle + Noun phrases describe the state or function of an object. For instance: replicating virus – a virus actively reproducing; differentiated cell – a cell that has completed the differentiation process; activated T-cell – an immune system cell in an active state (Zaid *et al.*, 1999). The use of such constructions allows for precise and unambiguous identification of biological objects, which is critically important in biotechnology, molecular biology, experimental protocols, and scientific publications.

The next frequently verbalised subcategory within the terminology of biotechnology is "chemical object" (95 terms, which represents 23.8% of the total sample of biotechnology terminology). This subcategory encompasses a wide range of chemical compounds, that play essential roles in biotechnological applications, from enzyme-catalysed processes and

pharmaceutical production to bio-based materials and molecular biology techniques. Chemical objects are fundamental for conducting experiments, producing biopharmaceuticals, and enabling industrial biotechnological applications. Examples: protein, lipid, carbohydrate, metabolite, peptide, vitamin, coenzyme, reactant, solvent, ion, acid, base, polymer, sterol, pigment, metabolite, nucleotide, nucleoside, phospholipid, polysaccharide, thiol, ester, aldehyde, ketone, aldehyde. Linguistic Representation: terms in this subcategory are primarily expressed as nouns, which can be divided into simple nouns representing basic chemical entities or biomolecules: enzyme, protein, lipid, substrate, coenzyme, ion, molecule, acid, base and complex nouns denoting more complex chemical structures or functional entities: polysaccharide, carbohydrate, nucleotide, oligosaccharide.

The category "chemical object" is also frequently represented by multi-word expressions, which provide precise and unambiguous designations of chemical compounds. Unlike simple nouns, these expressions combine multiple terms to describe a compound's composition, structure, or function. Examples include: amino acid, nucleic acid, polysaccharide chain, protein complex, carbohydrate polymer, peptide hormone, metabolite intermediate, and lipid bilayer (Kimball, 2002). These combinations specify the type of molecule, its chemical nature, or its role in a biological or experimental context. Noun + Noun phrases explain specific chemical compounds, where the first word defines the type or class, and the second specifies the molecule or function. Examples: amino acid, nucleic acid, peptide hormone, protein complex, polysaccharide chain, lipid bilayer. Adjective + Noun phrases describe the properties, type, or function of a chemical object. Examples: activated enzyme, oxidised coenzyme, soluble protein, recombinant Deoxyribonucleic Acid (DNA) (Kimball, 2002).

Participle + Noun phrases indicate the state, reaction, or functional status of a chemical object. Examples: synthesised compound, inhibited enzyme, denatured protein, activated enzyme, oxidised coenzyme. Additionally, abbreviations are widely used in biotechnology terminology to denote chemical compounds, biomolecules, or reagents concisely. Common examples include ATP (Adenosine Triphosphate), DNA, RNA (Ribonucleic Acid), rRNA (Ribosomal RNA), tRNA (Transfer RNA), NAD^+ (Nicotinamide Adenine Dinucleotide, oxidised form), PCR (Polymerase Chain Reaction), SDS (Sodium Dodecyl Sulfate), FAD (Flavin Adenine Dinucleotide), FMN (Flavin Mononucleotide), CoA (Coenzyme A) (Kimball, 2002).

Abbreviations allow scientists to refer to complex molecules concisely, ensuring clarity in protocols, diagrams, and research papers. Standardised abbreviations also support international consistency and reduce the risk of misunderstandings in collaborative and multidisciplinary research. The third numerous subcategory within the terminology of the biotechnology field "technological object" (84 items, 21% of the sample) encompasses tools, instruments, equipment, and devices used in biotechnological research, laboratory procedures, and industrial applications. Terms in this subcategory are typically expressed through nouns or noun phrases, which unambiguously denote specific technological entities. Examples: centrifuge, spectrophotometer, incubator, fermenter, bioreactor, pipette, microplate, microscope, autoclave, chromatograph, shaker, bioprinter, biosensor, electrophoresis unit, laminar flow cabinet, PCR machine, water bath, vortex mixer, microtome, cryostat (Kimball, 2002). Linguistic Representation: terms in this subcategory are expressed as simple nouns representing individual devices or equipment (centrifuge, pipette, incubator) or as complex nouns/compound phrases specifying functional characteristics, usage, or type (PCR machine, laminar flow cabinet, electrophoresis unit). Multi-word expressions are widely used to convey precise technical meaning, for example: stirred-tank

bioreactor, high-performance liquid chromatograph, microplate reader, automated DNA sequencer (Zaid *et al.*, 1999). Such constructions ensure clarity and prevent ambiguity, which is critical for laboratory protocols, experimental design, and scientific publications.

Noun + Noun phrases are often used to denote specific tools, instruments, or devices, where the first word defines the type or category, and the second specifies the element or function. Examples include: centrifuge tube, Petri dish, culture flask, micropipette tip, biosafety cabinet. Adjective + Noun phrases describe the properties, type, or purpose of a technological object. For instance: sterile container, magnetic stirrer, reusable glove. Participle + Noun phrases describe the state, function, or operational condition of the object. Examples include: automated pipette, calibrated instrument, sterilised equipment, heated incubator, autoclaved flask (Zaid *et al.*, 1999). Abbreviations are also frequently used to denote technological objects, particularly for instruments and laboratory techniques. Examples include: HPLC (High-Performance Liquid Chromatography), ELISA (Enzyme-Linked Immunosorbent Assay), FACS (Fluorescence-Activated Cell Sorting), GC-MS (Gas Chromatography – Mass Spectrometry) (Encyclopaedia of Biotechnology, n.d.). Standardised abbreviations facilitate concise communication in research papers, protocols, and collaborative projects, ensuring international consistency.

The fourth subcategory under consideration is "materials and products". Terms in this category represent final or intermediate biotechnological products, raw materials, reagents, and consumables, which are essential for laboratory work, industrial processes, and applied biotechnology research. This subcategory accounts for 75 entries, or 18.7% of the total sample, reflecting its significant role in experimental and practical applications. Examples: growth medium, culture broth, bioplastic polymer, recombinant protein, antibiotic solution, sterile medium, purified enzyme, synthetic polymer, activated charcoal, lyophilised powder, fermented broth, processed tissue, modified enzyme (Miglani *et al.*, 2025) Linguistic Representation: terms in this subcategory are typically expressed through nouns or word combinations, which clearly denote specific materials, products, or applications. These can be simple nouns: single-word terms representing basic products or materials (enzyme, protein, polymer, substrate) or complex nouns: multi-word terms specifying more detailed products, materials, or their functions (recombinant protein, bioplastic polymer, growth medium, culture broth) (Zaid *et al.*, 1999). Word combinations frequently used in this subcategory: Noun + Noun phrases denote specific products or materials, where the first word defines the type or category and the second specifies the particular product or function. Examples include: growth medium, culture broth, bioplastic polymer, recombinant protein, antibiotic solution. Adjective + Noun phrases describe properties, type, or function of products and materials. Examples: sterile medium, synthetic polymer, recombinant DNA. Participle + Noun phrases describe the state, treatment, or application of products and materials. Examples: lyophilised powder, fermented broth, processed tissue, modified enzyme, activated substrate, purified enzyme (Zaid *et al.*, 1999). Abbreviations commonly used in this subcategory include: GMO (Genetically Modified Organism), BSA (Bovine Serum Albumin), FBS (Fetal Bovine Serum), LB (Luria-Bertani medium), PCR (Polymerase Chain Reaction), IPTG (Isopropyl β-D-1-thiogalactopyranoside), DMEM (Dulbecco's Modified Eagle Medium), SDS (Sodium Dodecyl Sulfate) (Encyclopaedia of Biotechnology n.d.).

The use of such constructions ensures precise and unambiguous identification of materials and products, which is critically important in biotechnology, industrial processes, laboratory protocols, and scientific publications. In all subcategories of biotechnology

terminology, both simple nouns and compound phrases (Noun + Noun, Adjective + Noun, Participle + Noun) are used. Their frequency of use, however, depends on the specific subcategory of objects: simple nouns are more frequently used for biological objects and chemical compounds, whereas compound phrases predominate in the subcategories of technological objects and materials and products. This pattern can be explained by the need for precision and specificity in terminology. Biological objects and chemical compounds are often well-established entities with widely recognised names, so a simple noun is usually sufficient for identification. In contrast, technological objects and materials or products often require more detailed descriptions to specify their function, composition, or state, making compound phrases more appropriate for accurate and unambiguous designation. Table 2 presents the results of the quantitative analysis of the linguistic representation of the "object" category in English biotechnology terminology.

Table 2. *Linguistic representation of the "object" category in english biotechnology terminology*

Subcategory	Simple Nouns (units / %)	Compound Phrases (units / %)
Biological Objects	85 / 58.2	61 / 41.8
Chemical Objects	52 / 54.7	43 / 45.3
Technological Objects	39 / 46.4	45 / 53.6
Materials and Products	28 / 37.3	47 / 62.7
Total (400 units)	204 / 51.0	196 / 49.0

Source: *created by the authors*

Table 2 demonstrates that English biotechnology terminology within the "object" category includes both simple and compound structures. Overall, simple nouns (51.0%) slightly outnumber compound phrases (49.0%), indicating a relatively balanced distribution between single-word and multi-word terms. Biological Objects are predominantly represented by simple nouns (58.2%), reflecting the concise naming of living entities. In contrast, Materials and Products (62.7%) and Technological Objects (53.6%) favour compound phrases, which is typical for complex systems, equipment, and materials. Chemical Objects show an almost equal distribution between the two structures. The quantitative analysis revealed that most terms in the "object" category are noun-based, which is consistent with the norms of scientific and technical terminology. The total number of such terms is 204 out of 400, accounting for 51.0%, confirming their dominant presence in the dataset.

Other studies have explored similar trends in terminology formation. For instance, A. Tyutyunyk (2021) analysed the structural and semantic features of biotechnology terms, focusing on their morphological types (simple and compound) and the specifics of naming scientific objects. According to the author, although simple terms continue to hold a leading position in the biotechnology term system (45.5%), compound structures also account for a significant proportion (41.34%). This indicates the growing role of multi-component units, which allow for more precise and specialised naming of complex scientific concepts, objects, and processes. These findings generally align with observations made in this study, as they confirm the increasing prominence of compound term units in modern biotechnology terminology. At the same time, a slight divergence can be noted: while the author emphasises the predominance of simple terms in the overall corpus, current analysis showed that in certain subcategories – such as technological objects and materials – compound terms already prevail. This suggests that the rise in structural complexity within different subsystems of the field may occur unevenly.

At the same time, the analysis also highlighted a clear tendency toward the increased use of multi-component terms in biotechnology terminology. This trend has been noted by O. Syrotin (2012), who examined the structural organisation of biotechnology terms and the challenges associated with their translation, focusing on simple one-word units as well as two- and multi-component term combinations. The study emphasised that multi-word terms were increasingly used to provide greater precision in naming complex scientific concepts. The findings of the author generally aligned with the results of the present study: a substantial proportion of compound and multi-component terms was also observed in the compiled corpus. While simple terms remained frequent in some groups – consistent with the general observations of the author – current analysis showed that in certain subcategories, such as technological objects and materials, compound terms already predominated. Thus, the author's study is conceptually consistent with the present findings, while the current research adds quantitative evidence on the distribution of simple and compound terms across specific semantic subgroups.

M. Collins (2025) studied the etymological and lexico-structural mechanisms of term formation in biotechnology and noted the increasing role of multi-component terms for more precise communication of complex scientific concepts. Results of this study confirmed those findings and are considered valid, as extensive use of complex terms was also observed. At the same time, current study added a quantitative analysis and shows that in the subcategories of technological objects and materials, complex terms already predominate, which differs from the general picture described by M. Collins. Thus, current work confirmed main trends while expanding them with new empirical data.

O. Myshak (2017) investigated the occurrence and structural characteristics of multi-component terms in biotechnology discourse. The author observed that such terms appear frequently and that their number increases with the growing complexity of the subject area. The author also noted that the more components a term contains, the lower its polysemy, which reflects a higher level of precision and clarity – an aspect particularly important for professional scientific communication. These findings highlight the functional role of multi-component terms in reducing ambiguity and enhancing the accuracy of terminology in specialised fields. Overall, these conclusions were considered accurate and consistent with the findings obtained in this study, while the research provides a more detailed, empirical perspective on the uneven development of terminology complexity in biotechnology.

In biotechnology, terms denoting object category can be classified as simple (single-component) terms formed from a single element through reinterpretation, affixation, or complex (two-component) terms that are semantically completed and created by compounding, rethinking, or borrowing words; and terminological phrases (multi-component terms), which are semantically complete expressions combining two or more elements. Single-word terms may contain different numbers of word-formation components. Terms consisting only of the base (10 terms, 4.90%) include cell, gene, virus, enzyme, plasmid, protein, agent, frame, stem, and embryo. Terms formed by one base combined with one or more affixes include prefixal derivatives (5 terms, 2.45%) such as antibody, anticodon, antigen, anti-oncogene, and remark; suffixal derivatives (13 terms, 6.37%) such as nucleotide, peptide, recombinant, mutant, oxidant, polymerase, ligase, protease, amylase, albumin, actin, histone, and codon; and prefixal-suffixal derivatives (4 terms, 1.96%) such as biomarker, probiotic, antioxidant, and polymerase. Terms formed by compounding (9 terms, 4.41%) include bacteriophage, bacteriostat, immunosensor, bioengineer, bioreactor, carcinogen, biotechnology, biofuel, and pharmacogenomics (Zaid *et al*., 1999).

Complex terms used to denote object categories in biotechnology frequently incorporate neoclassical combining forms derived from Latin and Greek, including bio-, eco-, gen-, macro-, micro-, phyto-, and -plast. Examples include biotechnology, biofuel, biogas, biopesticides, biosensor, biotin, biotope, biochip, bioreactor, biosorbents, biotin, biotoxin, biotope, ecobiotechnology, ecotype, ecosystem, genomics, genotype, pathogen, macromolecule, macrophage, macronutrient, microsatellite, phytoplankton, phytochemicals, phytohormones, chloroplast, and cytoplast (Zaid *et al.*, 1999). According to E. Mattiello (2022), neoclassical combining forms in English derivational morphology should be considered a distinct class of combining forms. They occupy an intermediate position between roots and affixes, carrying their own lexical meaning while not functioning as independent words. These forms are productive elements of the word-formation system, enabling the creation of new terms through regular morphological rules. This perspective allows for a more precise description of the structure and mechanisms of term formation in modern biotechnology. G. Booij (2005) similarly emphasised the semi-autonomous nature of these forms and their capacity to generate new words according to regular, though somewhat limited, patterns. O.L. Garmash (2014; 2017) also noted the active use of neoclassical morphemes in forming complex scientific terms, particularly in bio-centric and techno-centric concepts, reflecting developments in genomics, bioinformatics, proteomics, and related fields. Table 3 presents word-formation patterns of single-word terms used for the linguistic representation of the category of "object" in English Biotechnology terminology.

Table 3. *Distribution of single-word terms by word-formation structure*

No.	Type of word-formation structure	Number of terms	Share (%)
1	Base only	10	24.39
2	Prefixal derivatives	5	12.20
3	Suffixal derivatives	13	31.71
4	Prefixal-suffixal derivatives	4	9.76
5	Compounding (compound terms)	9	21.95
Total		41	100

Source: *created by the authors*

The word-formation analysis of single-word terms revealed varying productivity among different patterns. Suffixal derivatives formed the largest group (31.71%), indicating their high productivity. Compounds (21.95%) and base-only terms (24.39%) also contributed significantly, reflecting lexical economy and semantic richness. Prefixal and prefixal-suffixal derivatives together accounted for 21.96%, highlighting their auxiliary but stable role in term formation. Similar findings were reported by O. Rak *et al*. (2023) in their analysis of English terminology of infectious diseases, where suffixal formations also dominate. This demonstrates common word-formation patterns in both medical and biotechnological English terminologies.

The relative low productivity of prefixal nouns in terminology systems is also confirmed by other studies. In this context, Y. Togano (2024) emphasised that prefixation in English mostly does not change the grammatical category of a word but only expands its lexical-semantic meaning. According to him, prefixes function more as lexemes or fully meaningful units rather than as classical morphemes, which further limits their role in the formation of nouns in scientific terminology.

At the same time, in the study by M. Bogachyk & D. Bihunov (2020), devoted to the

structural-semantic features of English computer terminology, it was shown that prefixal formations account for 14.3% of all analysed units, while prefixal-suffixal ones make up only 1.8%. This indicates that the productivity of word-formation models largely depends on the sectoral specificity of the terminology system. In biotechnological terminology, models related to the description of biological structures dominate, where suffixation and compounding play a more important role, whereas in the computer field, prefixes are more often used for the rapid creation of new functional terms. Prefixes mostly only modify the meaning of a word without changing its grammatical category, which limits their word-formation potential.

In the considered terminology, alongside complex words, terminological phrases also function as semantically coherent combinations of two or more components. Among these, attributive phrases (80 units, 40.8%) are formed by a stem noun and a fully inflected adjective in the pattern "adjective + noun". In such phrases, the noun in the nominative case serves as the main element, while the adjective functions as a prepositive modifier. The noun conveys the general concept, while the adjective specifies a particular feature. Examples include: bioactive component, genetic code, microfluidic reactors, protein structure, nucleotide sequence, genetic sequence, genetic map, genomic library, transgenic organism. Object phrases (60 units, 30.6%) consist of a noun combined with a defining component in the genitive case, specifying the concept of the object. Examples: cell membrane, protein structure, gene sequence, molecule composition, gene guns, cell culture. Mixed phrases (56 units, 28.6%) involve multiple syntactic relationships within a single term, reflecting more complex conceptual structures. Examples include: protein structure of the enzyme, cell culture medium of the bacteria, nuclear protein complex, antigen-presenting cell, genetic mutation rate, viral vector system, cell signaling pathway, enzyme-substrate complex, genetic make-up of an organism. Table 4 presents the distribution of terminological phrases by structural type.

Table 4. *Distribution of terminological phrases by structural type*

No.	Type of terminological phrase	Number of units	Share (%)
1	Attributive phrases	80	40.82
2	Object phrases	60	30.61
3	Mixed phrases	56	28.57
Total		196	100

Source: *created by the authors*

The analysis of terminological phrases shows that attributive phrases (40.82%) dominate, highlighting the role of adjectives in specifying biotechnological concepts. Object phrases (30.61%) and mixed phrases (28.57%) reflect relational and complex syntactic structures, demonstrating how morphology and syntax together ensure precise expression of scientific terms. A similar conclusion was reached by H. Syrotina (2022), who, within the conducted study devoted to the conceptual categories represented in English-language biotechnological terminology, analysed the grammatical models of terminological phrases. The author established that, despite being less productive than the A + N model, the N + N structure remains relevant for denoting substantive terms with attributive meaning, where the head component occupies the final position in the phrase. In turn, O. Brona (2023) found that in English scientific texts, the frequency of noun modifiers exceeds that of adjective

modifiers. Although linguistic tradition favours the use of relational adjectives as terminological attributes – forming complex term phrases that convey qualitative features and ensure the synthetic integration of knowledge necessary to reveal a term's semantic potential – the predominance of noun modifiers reflects the specificity of scientific discourse. The composition of terminology also depends on the field of science – humanities, social sciences, natural sciences, or technical disciplines. While all of them name entities, objects, and phenomena, humanitarian and social sciences tend to use more nouns, whereas natural and technical sciences demonstrate a higher quantitative presence of nominal components.

In the analysed terminology, the use of multicomponent terms is widespread. Since biotechnology deals with living organisms (bacteria, cells, plants, animals) and their genetic, physiological, and biochemical characteristics, the detailed and precise definition of terms is essential for describing complex biological entities. For example, terms such as genetically modified organisms (GMOs), microbiological strains for bioremediation, microscopic cell cultures, and stem cell cultures make it possible to specify which organisms are involved in a particular biotechnological process, indicating their modifications, properties, or functions. The prevalence of terminological phrases in modern scientific fields, including biotechnology, is explained by the need to name complex conceptual components and to specify professional notions and objects as their nature becomes better understood and new aspects of the studied phenomena are revealed. Terminological phrases not only denote and differentiate newly emerging concepts but also systematise paradigmatic relations among them, reflecting the structural and conceptual interconnectedness within a specific terminological system.

When analysing multi-component terms used to verbalise the object category in biotechnology, it is important to consider the role of abbreviations. In this field, as in many other scientific and technical domains, abbreviations greatly simplify communication and save time. Given the complexity of terminology and the need for rapid information exchange, long names of compounds, processes, or methods are often replaced with shorter forms. Abbreviations allow scientists to convey information concisely and avoid misunderstandings, especially in international contexts. Graphic abbreviations used to denote object categories in biotechnology are divided into monolexemic and polylexemic types. Monolexemic abbreviations consist of a single lexeme, typically formed by shortening or acronyms, and are often applied to molecules, genes, proteins, or chemical compounds. They include initial abbreviations (A – adenine, C – cytosine, G – guanine, T – thymine, Ab – antibody, Da – Dalton), frame abbreviations (ala – alanine, cv – cultivator, lys – lysine), and truncations (sperm – spermatozoon, exo – exonuclease, mono – monocyte). Polylexemic abbreviations are formed from several lexemes or word combinations and convey more complex information, for example, GMO, ATP, RNA, and DNA. They include proper-initial abbreviations formed from initial letters, such as GMO, HAC (Human Artificial Chromosome), ESC (Embryonic Stem Cell), BAC (Bacterial Artificial Chromosome), and YAC (Yeast Artificial Chromosome). Other types comprise initial-combined abbreviations that include service parts of speech, such as GMOs (Genetically Modified Organisms), mAbs (Monoclonal Antibodies), PIPs (Plant-Incorporated Protectants), and partial-initial abbreviations formed by shortening parts of words, such as Bt corn (biotechnological corn), GM food (genetically modified food), HT crops (Herbicide-Tolerant crops), and GE fish (Genetically Engineered fish) (Zaid *et al.*, 1999).

The growing number of abbreviations and acronyms in biotechnology reflects the rapid evolution and increasing complexity of the field. As areas such as synthetic biology,

gene editing, and bioinformatics continue to expand, new terms are created and quickly adopted in abbreviated forms to enhance clarity and efficiency in scientific communication. The obtained results confirmed the conclusions of modern studies regarding the dominance of nominal structures in scientific and technical terminology, which can be explained by their ability to concisely convey the essence of a concept and ensure unambiguity in professional communication. The revealed tendency toward the use of compound names in the field of biotechnology indicates the dynamic development of the industry, where new concepts require precise linguistic representation through the combination of basic and specifying components.

Conclusions

The study showed that the category "object" in English biotechnology terminology is multidimensional and includes four main subcategories: Biological, Chemical, and Technological Objects, as well as Materials and Products. Biological Objects account for the largest share of terms (36.5%), which is explained by their key role in research and their predominance as simple nouns. Materials and Products are less frequent (18.7%) because they are the final outcomes of processes and are more often represented by complex terms, which limits their prevalence in the terminological corpus. The distribution of terms reflects a balance between fundamental biological and chemical research and the applied aspects of technology and production, highlighting the complex nature of the object category in the field of biotechnology. For the linguistic representation of the category "object" in English biotechnology terminology, both simple and complex structures are used. Simple nouns slightly outnumber complex phrases (51.0% vs. 49.0%), with Biological Objects mostly represented by simple nouns (58.2%), while Materials and Products (62.7%) and Technological Objects (53.6%) are more often expressed as complex forms. Chemical Objects show an almost even distribution between these two structures. Overall, most terms in the "object" category are nouns (51.0%), which aligns with the norms of scientific and technical terminology. Simple terms are formed by using the word base alone, adding prefixes or suffixes, combining prefixes and suffixes, or compounding base components. Suffixal derivatives formed the largest group (31.71%), indicating their high productivity. For the linguistic representation of the category "object", terminological phrases are used as semantically coherent units. Attributive phrases (40.8%) combine a noun with a prepositive adjective, specifying the features of the concept (e.g., bioactive component, genetic code). Object phrases (30.6%) include a noun with a genitive modifier, defining relationships between components (e.g., cell membrane, gene sequence). Mixed phrases (28.6%) involve multiple syntactic links, reflecting more complex conceptual structures (e.g., enzyme-substrate complex, genetic make-up of an organism).

Thus, understanding the nature of an object in biotechnology allows for a more precise determination of which biological, chemical, or technological components serve as the basis for research, product development, and process optimisation. The study of terms representing these objects is crucial for systematising knowledge in the field and ensures accurate and unambiguous representation of concepts in scientific and technical texts. In this way, the terminology that represents objects forms the foundation for effective knowledge exchange, the description of technological processes, and the advancement of biotechnological practice. A promising direction for further research is the study of the linguistic representation of the category "feature" in English biotechnology terminology, as it will help clarify how the specific characteristics of biological, chemical, and technological objects are conceptualised and reflected in terms, as well as how they relate to

the development of biotechnological products with enhanced properties.

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Лінгвістична репрезентація категорії «об'єкт» в англомовній біотехнологічній термінології

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Анотація. Актуальність статті зумовлена необхідністю дослідження, спрямованого на вивчення того, як категорія об'єкт репрезентується в англомовній біотехнологічній термінології. Мета роботи полягала у виявленні підкатегорій категорії «об'єкт», які мають своє лексичне вираження, а також у дослідженні лінгвістичних механізмів, зокрема морфологічних і синтаксичних структур, що використовуються для їх позначення. Для досягнення поставленої мети було застосовано комплекс вибіркового, аналітичного, морфологічного, структурно-семантичного, класифікаційного, системного та статистичного методів. Встановлено, що в англомовній біотехнологічній терміносистемі категорія «об'єкт» включає чотири основні підкатегорії: біологічні (36,5 %), хімічні (23,8 %), технологічні (21,0 %) об'єкти, а також матеріали та продукти (18,7 %). Для мовної репрезентації англомовної біотехнологічної термінології в категорії «об'єкт» використовуються як прості, так і складні синтаксичні конструкції. Біологічні об'єкти переважно виражаються простими іменниками, тоді як технологічні об'єкти та матеріали і продукти частіше представлені складними синтаксичними конструкціями. Хімічні об'єкти демонструють майже рівномірний розподіл між простими та складними формами. Загалом більшість термінів є іменниковими, що відповідає нормам науково-технічної термінології. Отримані результати підтвердили висновки сучасних досліджень про домінування іменникових структур та тенденцію до використання складних синтаксичних конструкцій у біотехнологічній термінології, що зумовлено потребою у точності й системності фахової номінації. Практичне значення дослідження зумовлене можливістю використання отриманих результатів у процесі викладання іноземної мови за професійним спрямуванням для студентів спеціальності «Біотехнології та біоінженерія»

Ключові слова: категоризація; підкатегорії; номінальні структури; фрази; лексичне вираження

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Conceptual and metaphorical models of contemporary English-language cybersecurity terminology

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Abstract. The relevance of the study is conditioned by the rapid development of digital technologies and the need for linguistic understanding of how specialised terminology forms a professional picture of the world in the field of cybersecurity. The purpose of the study was to identify, systematise, and cognitively interpret conceptual metaphors in contemporary English-language cybersecurity terminology, and to determine their role in the processes of conceptualisation of digital threats and defence mechanisms. The research was based on the provisions of the theory of conceptual metaphor and was aimed at identifying mechanisms of linguistic conceptualisation of abstract processes related to information security, digital threat management, and the functioning of cyberspace. The material of this scientific research consisted of 4,000 English-language terms selected from the authoritative English-Ukrainian dictionary of terms on information technology and cybersecurity. The methodological basis was cognitive and metaphorical analysis, semantic classification, component and quantitative analysis, which helped to establish the hierarchy and performance of metaphorical models in the terminology under study. As a result of the analysis of cybersecurity terms, it was found that a significant part of them was formed based on conceptual metaphorisation. The most productive were ontological metaphors (436 units), in which cybersecurity was understood as a control, system, cipher, or data storage container. A significant group consists of natural metaphors that include models of fluids, plants, and animals, and medical metaphors related to the conceptualisation of computer viruses. Among the structural metaphors (416 units), the metaphor "cybersecurity is military operations" (attack, threat, combat, weapons) dominates, and the architectural model "cybersecurity is home" (access keys, locks, gateways). Orientation metaphors turned out to be small in number and perform mainly a navigation

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function, providing a hierarchy of concepts such as threat level, security level, attack vectors, and system boundaries. The practical significance of the study lies in the possibility of using its results in research on cognitive linguistics, terminology, discourse analysis, and in training courses and applied developments related to digital communication and information security

Keywords: cognitive linguistics; language conceptualisation; digital threats; term; figurative models

Introduction

In English-language terminology and professional cybersecurity discourse, conceptual metaphors play a key role in understanding abstract technical phenomena related to the protection of information, data, and digital systems. The relevance of the study is conditioned by the rapid development of digital technologies and the growing role of cybersecurity as a key factor in the functioning of contemporary society. Cyberspace is increasingly becoming an arena of conflicts, threats and risks, which requires not only technical, but also linguocognitive approaches to their understanding and representation. In this context, the language of cybersecurity performs not only a nominative, but also a conceptualising function, forming an idea of digital threats through the prism of everyday physical, social, and cultural experience of a person. The use of cognitive metaphors, which serve as the main mechanism for verbalising abstract and technically complex processes, becomes important. Despite the existence of separate studies of the conceptual metaphor in scientific and media discourse, metaphorical models of cybersecurity remain insufficiently systematised, and their role in shaping the professional picture of the world of specialists and non-specialists requires a thorough analysis. This necessitates a comprehensive linguocognitive study of metaphors in contemporary English-language cybersecurity discourse.

The tradition of metaphor research was formed primarily in cognitive linguistics, where metaphor was considered as a fundamental mechanism of conceptualisation and thinking. T. Dyrmo (2025) developed the ideas of an extended conceptual metaphor, suggesting a revision of the traditional hierarchy of levels of metaphorical organisation of meaning. The researcher introduced a multidimensional model of metaphorisation that combines semantic, cognitive, and semiotic parameters of analysis. Attention was paid to multimodal forms of metaphorical expression, which include the interaction of verbal, visual, and other semiotic resources in the process of constructing meaning. The researcher also introduced the concept of submetaphores as smaller cognitive structures that form more complex metaphorical systems in discourse. This approach allows describing the processes of the development of meaning as a multi-level dynamic system, where meaning is formed through the integration of various channels of perception and interpretation of information. Thus, O. Kramer (2025) considered the Extended Conceptual Metaphor Theory (CMT) in a new technological context, suggesting the use of cognitive and metaphorical principles as a basis for forming strategies for prompting large language models. The researcher proved that metaphorical structures can be used to improve the quality of text generation by artificial intelligence, since they reproduce the natural cognitive patterns of human thinking. The study analysed ways to integrate cognitive semantics with machine learning methods, in particular, through the use of metaphorical scenarios as templates for forming instructions for language models. The prospects of an interdisciplinary approach combining cognitive linguistics, computer

linguistics and artificial intelligence technologies were emphasised separately.

I. Kryknitska (2024) proposed a modified algorithm for analysing conceptual metaphors aimed at improving the accuracy of identifying metaphorical units in the text. The proposed method was based on a combination of cognitive and semantic analysis with a procedural approach to processing speech material. The algorithm allowed automating some of the analytical procedures related to identifying source and target domains, and establishing hierarchical relationships between different levels of metaphorical generalisations. The researcher also noted the possibility of using the proposed algorithm to investigate complex discursive structures and analyse metaphorical networks in large text cases. M. Banevych (2025) investigated the functioning of conceptual metaphors in political discourse, focusing on their pragmatic and manipulative role in shaping public opinion. The researcher showed that political metaphors perform not only a nominative function, but also act as a tool for evaluating political events, constructing ideological positions and influencing the emotional perception of the audience. The researcher analysed strategies for metaphorical representation of political actors and events, demonstrating how metaphors can be used to strengthen argumentation, create emotional resonance, and form a cognitive framework for interpreting political information. H. Stroganova (2025) conducted a comprehensive analysis of the evolution of scientific views on the linguocognitive nature of metaphor, tracing the transition from classical structural models to contemporary cognitive and discursive and multimodal approaches. The paper emphasised that metaphor was considered not only as a stylistic tool, but also as a universal mechanism for conceptualising experience and categorising reality in human thinking. The researcher analysed in detail the relationship between cognitive processes, socio-cultural context and linguistic representation of meanings, emphasising the role of discursive practices in the development and transformation of metaphorical models. Attention was paid to integrating cognitive linguistics with semiotic and communicative approaches to metaphor analysis.

D. Gaskins (2024) applied a usage-based approach to the study of metaphorical structures in children's speech, combining cognitive linguistics with empirical methods for analysing speech corpus. The paper used the step-by-step Metaphor Identification Procedure (MIP) and its extended and improved version of the Metaphor Identification Procedure Vrije Universiteit (MIP-VU) to systematically identify metaphorical units and analyse their functioning in children's natural speech. The researcher demonstrated that the development of metaphorical models in children's speech was associated with the frequency of language constructions, contextual support for meanings, and the gradual development of abstract thinking. In addition, the study in question confirmed that metaphorisation plays an important role in a child's cognitive development, in particular, in the processes of categorising experience and forming semantic networks of meanings. The research has formed the theoretical and methodological framework of contemporary metaphor studies, focusing on CMT expansion, analysis automation, and interdisciplinary connections. The purpose of the study was to identify, systematise, and cognitively interpret conceptual metaphors in contemporary English-language cybersecurity terminology, and to determine their role in the processes of conceptualisation of digital threats and defence mechanisms. To achieve this objective, the following tasks were set: to summarise theoretical approaches to the study of conceptual metaphor within the framework of cognitive linguistics, followed by the identification of the main conceptual metaphorical models in the material under investigation; to classify metaphors by source domains (human, war, medicine, space,

container, etc.); to determine the quantitative ratio of the main metaphorical models.

Materials and Methods

The research material consisted of 4,000 terminological units of English-language cybersecurity terminology selected from the English-Ukrainian dictionary of information technology and cybersecurity terms (Hladun *et al*., 2018). The use of a dictionary source ensured the standardisation of the material, the representativeness of the terminological system, and the ability to analyse well-established lexical units of industry discourse. Additionally, scientific monographs, articles on cognitive linguistics, and terminological encyclopaedic sources were used for theoretical substantiation, which provided the development of a conceptual and methodological base for research (Gibbs, 1994; Selivanova, 2008; Steen *et al*., 2010). The methodological basis of the study was based on a combination of general scientific, cognitive and linguistic, and quantitative and statistical methods of analysis. The leading method was cognitive and metaphorical analysis, applied within the framework of the theory of conceptual metaphor (Lakoff & Johnson, 1980). Its use was conditioned by the need to identify mechanisms for conceptualising abstract cybersecurity phenomena through the prism of more specific human experience. The method helped to identify correspondences between the source sphere (man, war, disease, container, space, etc.) and the target sphere (cybersecurity as a conceptual domain), and to describe cognitive models of understanding cyberspace as part of socio-psychological and cultural experience.

To systematise the empirical material, the semantic field method was used, which was used to group terms according to common conceptual features. This method allowed establishing thematic and semantic links between metaphorical categories that represent various aspects of cybersecurity, in particular, threats, protection, information processes, and cyberspace. The semantic field method helped to further typologise metaphorical models and determine their system organisation within the terminological subsystem. Component analysis was used to clarify semantic transformations and analyse the internal structure of terms. This method determined the semantic components of the meaning of terms, in particular, to identify the actualisation of individual semes during metaphorical transfer (for example, the semes of defence, aggression, penetration, control, violation of integrity). The use of component analysis was important for establishing mechanisms of terminological metaphorisation and determining the cognitive characteristics of the field under study. An important role in the study was played by the quantitative method of analysis, which was used to determine the frequency of use of various types of metaphorical models. Quantitative analysis allowed providing an objective interpretation of the results by statistically comparing the performance of conceptual schemes and establishing dominant metaphorisation trends in the English-language cybersecurity discourse. Frequency counting was carried out by continuous sampling of terminological units, followed by their classification grouping. The theoretical basis of the study was the provisions of the theory of conceptual integration, which explained the process of forming complex abstract concepts through the combination of several cognitive spaces (Fauconnier & Turner, 2002). The use of this theory allowed interpreting complex metaphorical structures as the result of the interaction of several cognitive scenarios and explaining the mechanisms of development of metaphorical submodels.

The hierarchical approach to metaphor analysis developed by Z. Kövecses (2020) was also used, which predicted the distinction between general conceptual metaphors, specific submetaphores, and metaphorical consequences (entailments). The identification of

metaphorical terms was carried out using a step-by-step algorithm: development of the research corpus – selection of 4,000 terms from a specialised English-Ukrainian dictionary of information technology and cybersecurity; initial semantic analysis – establishing the literal and terminological meaning of the lexeme; identifying semantic discrepancies between the source domain and the target domain; determining the source domain and the target domain; classifying metaphors by types of conceptual models and calculating their frequency. The analysis of metaphorical models was based on the provisions of conceptual metaphor theory (Lakoff & Johnson, 1980), the principles of cognitive semantics (Selivanova, 2008), conceptual integration theory (Fauconnier & Turner, 2002), and a hierarchical approach to the organisation of metaphorical models (Kövecses, 2020). The identification of metaphorical units was carried out considering the procedural approach (MIP/MIPVU) (Gibbs, 1994; Steen *et al.*, 2010), which ensured the consistency and reproducibility of the results obtained.

Results and Discussion

As a result of the analysis of terminological material, a number of conceptual models of metaphorisation in the field of cybersecurity were identified. A significant group consists of ontological metaphors that represent the abstract concept of cybersecurity as an object, being, or substance. In particular, a common model is "cybersecurity is a person" (12 terminological units), implemented through the personification of systems that are attributed to physical or psychophysiological characteristics, in particular "vulnerability", "health" or "sustainability", for example: handshake, backbone, backbone network, biometric identification, blind copy recipient. In addition, ontological metaphors within the material being studied (Hladun *et al.*, 2018) perform not only a nominative, but also a cognitive and interpretive function, since they contribute to understanding complex technical processes through an appeal to everyday human experience. Personification of elements of cyberspace allows conceptualising security as a dynamic state that can change depending on the level of security of the system, the intensity of threats, or the effectiveness of defence mechanisms.

In the "cybersecurity is a person" model, the system appears as an entity capable of "interacting", "responding", or "being harmed", which reinforces the anthropocentric nature of cybersecurity discourse. Such a metaphorical projection also helps to simplify specialised terminology and facilitates its interpretation for both specialists and non-professional audiences. Within the same group, there is a metaphor "cybersecurity is medicine", where threats are understood as diseases or viruses, and protective measures – as treatment, immunity or prevention, for example: sanitising, vaccine, bacterium, virus. In the studied dictionary, 19 types of computer viruses were recorded, for example: boot virus, companion virus, file virus, macro virus, mutant virus, parasitic virus, resident virus, shattered virus, etc. The biological concept of a pathogenic microorganism is transferred to the field of information technology to describe programme code that can independently spread and damage the system. Due to this transfer, complex technical processes are explained through a well-known biological model of infection.

Metaphors are also ontological in nature, in which data appears as a physical substance or object. The "cybersecurity is food" (salt) and "cybersecurity is a container" models (16 units, for example: backing storage, external storage, internal storage, magnetic disk storage, main storage) represent information as something that can be "consumed", "accumulated", "stored" or "lost", and the systems themselves as a limited space with clear boundaries, penetration beyond which is a threat. An example is the term "honeypot", which comes from a household metaphor. In the literal sense, the

word refers to a vessel for storing honey that attracts animals or insects. In cybersecurity, this image is used to refer to a specially designed system or bait server designed to detect intruders. Metaphorical transference is based on a conceptual scheme in which the hacker is likened to a subject who succumbs to temptation.

A similar function is performed by the metaphor "cybersecurity is documentation", in which information processes are conceptualised through images of certificates, protocols, signatures and certificates. Thus, the following metaphorical submodels were identified: "cybersecurity is a protocol", within which 80 terminological units were recorded for various types of protocols, for example: address resolution protocol, authentication protocol, border gateway protocol, connectionless network protocol; "cybersecurity is a document", represented by 40 types of documents, for example, data protection document, guidance data protection document, hardware documents, etc.; "cybersecurity is a certificate" (17 units) – access control certificate, DevID Certificate, public key certificate, etc.; "cybersecurity is a signature" (13 units), for example: undoubted signature, virus signature, voice signature, etc. Thus, the metaphor "cybersecurity is documentation" reflects the desire for streamlining, formalisation, and normativity in the field of cyber defence, where security appears as a result of compliance with established rules and procedures. Conceptualisation of information processes through documentary images emphasises their legitimacy, reproducibility, and controllability. Within this metaphorical model, cybersecurity is understood as a set of formalised actions consolidated in texts, standards, and certification mechanisms that regulate access, authentication, and data exchange. The selected submodels demonstrate a high degree of structuring of the terminological field and confirm the dominance of regulatory logic, in which the security of the system depends on the correct "registration", "signing", and "confirmation" of information operations. This method of metaphorisation contributes to the cognitive simplification of complex technical processes and at the same time strengthens the idea of cybersecurity as a formally fixed and managed state. The metaphor "cybersecurity is a system" is also an ontological reification model, within which an abstract phenomenon is understood as an integral structured entity. It is represented by 32 elements, for example: system, subsystem, class (class AC/ADO/ADV/FDP/FIA, etc.), category (cloud service category, information struggle category, etc.), functional family, specification, model (comprehensive model, information leak channel functional model, model of threats to information), etc.

Within the framework of the metaphorical model "cybersecurity is a system", the emphasis is shifted to the internal organisation, hierarchy and interdependence of the components of the security space. Cybersecurity appears as an ordered set of elements, each of which performs a specific function and is in a relationship of subordination or coordination with other components. This conceptualisation allows understanding the security of information resources not as a static state, but as a result of the coordinated interaction of subsystems, classes, and models that form a single functional whole. In general, the metaphor "cybersecurity is a system" reflects the scientific and technical way of understanding security processes and correlates with the desire for standardisation and a systematic approach in contemporary English – language terminology. A separate subgroup consists of metaphors of natural origin ("cybersecurity is nature"), where threats appear as animals, plants or liquids and are structured, respectively, by a number of sub – metaphors: "cybersecurity is a plant" (5 units), for example: sprout, tree, B-tree, search tree, tree structure; "cybersecurity is an animal", which includes the following 3 terminological units: Trojan horse, Trojan worm, bug; "cybersecurity is a liquid", represented by 29 units like data-flow, digital

flow, flow of documentary information, information flow, packet flow, information leak, etc.

Thus, metaphors of natural origin appeal to the basic schemes of human experience of interaction with the environment and serve as an effective means of conceptualising complex and dynamic processes in cyberspace. In the "cybersecurity is nature" model, security phenomena and threats are understood as those that can arise, spread, accumulate or get out of control, similar to natural processes. In particular, plant metaphors emphasise the hierarchy and branching of information structures, zoomorphic images emphasise the hidden, invasive or parasitic nature of malicious software, while fluid metaphors reflect the continuity of data movement and the potential uncontrollability of their distribution. This type of metaphorisation contributes to the development of the idea of cyber threats as dynamic and changing phenomena that require constant monitoring and timely intervention, and simultaneously enhances the emotional and evaluative component of cybersecurity discourse.

The ontological metaphor also includes "cybersecurity is a cipher" (59 units), in which abstract information security processes are objectified through material coding elements, for example: code element, code set, cryptic code, cipher, Aiken/Baudot/Gray/Manchester/Hamming, Huffman/Markovian code, cipher stability, cipher suite, decipherement, decode, etc. The metaphor "cybersecurity is a cipher" represents one of the most technically labelled types of ontological reification, in which security appears as a set of formalised codes and operations with them. Through this metaphorical projection, information security processes are conceptualised as those that can be created, hacked, enhanced, or optimised, just like material objects. Simultaneously, the cipher metaphor actualises the "available/unavailable" opposition, which is key to understanding information control in the digital environment. The conceptual metaphor "cybersecurity is control" also belongs to the ontological type, since the abstract sphere of cybersecurity is understood as an object of control that can be regulated, strengthened or lost. It is represented by 105 elements, for example: access check, check authenticity with artificial information redundancy, connection admission control, flow control. Based on this ontological projection, cyberspace is understood as a controlled object with certain points of intervention and monitoring, which contributes to the development of an idea of cybersecurity as a controlled and predictable process. Terminology units that implement this metaphor reflect various aspects of managing information flows, access, and authenticity, and emphasise the engineering and procedural nature of contemporary cyber defence.

Quantitative analysis has shown that these ontological models do not function in isolation, but form an interconnected conceptual network. The most productive models are "cybersecurity is control", "cybersecurity is a cipher" and "cybersecurity is a document", which together form the core of the term system. Their high frequency indicates that the professional picture of the world of cybersecurity specialists is based on the idea of the digital space as a managed system in which information is subject to formalised regulation, verification, and protection. Thus, these models can be considered as conceptual dominants that organise a significant part of specialised vocabulary and form a hierarchical structure of submetaphores. Structural metaphors play a leading role in the studied cybersecurity terminology, since they set the logic for interpreting the entire industry. The most dominant and extensive model is "cybersecurity is a military action", within which the following submethaphores are recorded: "cybersecurity is an attack" (49 units): active attack, attack to network of exchange of information, brute force attack, etc.; "cybersecurity is a fight" (3 elements): hash clash, collision; "cybersecurity is a fight" (13 terms): computer crime struggle, information

struggle, etc.; "cybersecurity is protection", which includes 9 units, for example: copy protection, data protection, password protection, redundancy protection, administrative security, communications security, compusec – computer security, COMSEC – communications security, cryptographic security; "cybersecurity is war", which contains 10 elements, for example: cryptography war, psychological warfare, radio [electronic] warfare, signs of preparation for armed struggle in psychological warfare field; "cybersecurity is a strategy" (4 units): information strategy, security strategy, etc.; "cybersecurity is a weapon" (9 terms): counteraction information weapons, information – algorithmic weapon; "cybersecurity is the enemy" (10 units): adversary, enemy, opponent; "cybersecurity is a threat", which is implemented by 20 elements, for example: covert threat, potential threat to security of information in local computer network, threat of dysfunction.

Given the quantitative indicators and diversity of submethaphores, it can be assumed that the military model serves as a leading conceptual macromodel, within which a significant part of metaphorical projections in cybersecurity terminology is organised. It forms the basic cognitive framework for understanding digital threats, where cyberspace is interpreted as a field of confrontation between subjects, tools, and strategies. The frequency of such source areas as attack, enemy, threat and defence correlates with the nature of contemporary digital risks and reflects the professional paradigm of cybersecurity, in which the activities of specialists are thought of as a system of permanent defence, monitoring and counteraction. Structural metaphors also include "cybersecurity is a home" and "cybersecurity is a transport" (platform, pilotless vehicle, terminal, traffic). In the first case, digital systems are understood as architectural structures with entrances, exits, and hidden passageways, while in the second case, data transmission is interpreted as traffic on transport routes. Thus, the metaphor "cybersecurity is a home" is implemented through submodels: "cybersecurity is a lock" (16 units): data interlock, deadlock, software lock; "cybersecurity is a door/gate" (12 elements): trapdoor, gateway, etc.; "cybersecurity is a key" (62 units): access control key, compromised key, database key, long-term key; "cybersecurity is a wall" (2 terms): firewall, brandmauer. An illustrative example of metaphorical transfer within this model is the term "firewall". In the original sphere, the word refers to a physical fire barrier designed to contain the spread of fire between parts of the building. In the field of cybersecurity, this material construct serves as a source for conceptualising a software or hardware mechanism that blocks unwanted network traffic. Thus, the complex technical process of data filtering is understood through the image of a material barrier, which enhances the visibility and clarity of the term in professional discourse.

The metaphor "cybersecurity is home" allows conceptualising information security through images of architectural elements, emphasising the structure and hierarchy of the security system. Each component of the "house" performs a specific function: walls block unwanted access, locks, and keys regulate control over resources, doors, and gates coordinate interaction between subsystems. Through this structural metaphorisation, terminological units reflect order, control, and security, which provides a cognitive picture of cybersecurity as a reliably organised, managed, and predictable space. In general, this type of metaphor helps to understand data protection processes not only at the technical level, but also at the level of intuitive perception, enabling an easy interpretation of complex security mechanisms through familiar architectural images. Less productive are the metaphors "cybersecurity is work" (4 elements, for example: sniffer, spy, scout, recruitment) and "cybersecurity is mathematics" (24 terms: Euler phi function Bell-LaPadula model, radix, matrix, variable, zero, algorithm, gamma,

graph), which, however, emphasise the rational, manageable and formalised nature of information security processes. Mathematic metaphors in cybersecurity reflect the desire for rational organisation, formalisation, and accuracy of information security processes. The metaphor "cybersecurity is mathematics" allows understanding cyber defence through algorithmic and structured operations, where data and processes obey logical rules and formal laws. In particular, Bell-Lapadula access models provide mathematical formulation of privacy policies in information systems. Algorithmic concepts such as the Leonhard Euler function or Richard Hamming codes are used to build error-resistant encryption systems and verify data integrity. Graph structures and matrices reflect the relationships between objects, data streams, and transmission channels, which allows for formalised risk assessment and threat modelling. In this case, metaphorisation is based on transferring the properties of mathematical accuracy, formalisation, and algorithmicity to the field of information security. Such conceptual modelling allows interpreting cybersecurity as a system of computational processes where risks, vulnerabilities, and security mechanisms can be formally described and predicted. As a result, mathematical concepts perform not only a terminological, but also a cognitive and organisational function, structuring knowledge about the security of digital systems.

Socially oriented structural metaphors are represented by the models "money" (3 units – cybermoney, e-money, electronic money), "economy" (15 terms, for example: economic management/rivalry/efficiency, resources/distribution/registration/infrastructure/strategy, databank, stakeholder, transaction), and "powers" (6 elements, for example: authentication, credentials, administrative domain, expert), and "cybersecurity is law", which traces further internal differentiation. This model is structured into the following submethaphores: "cybersecurity is a right" (12 elements): copyright law, digital law, (military) legislation, jurisprudence, evidence, verdict; "cybersecurity is a crime" (16 units, for example: false, falsification, computer crime, criminal, infringer, violator, etc.). The sub-metaphors "law" and "crime" reflect opposition to legitimate and disruptive behaviour in a digital environment where policies, norms, and sanctions form the framework for action, and cybercrimes are presented as specific violations of these rules. They conceptualise cybersecurity through norms, responsibilities, data values, and access distribution, reflecting the managerial and institutional nature of modern cyberspace.

Peripheral, but cognitively significant are the metaphors "film" (scenario, screening) and "art" (information portrait). Despite the relatively small number of such units, their presence indicates the expansion of the conceptual space of cybersecurity beyond purely technical models. The use of cultural sources, such as art or cinema, reflects the desire to interpret complex information processes through scenario or image structures. This demonstrates a tendency to integrate technical, social, and cultural experience into the development of contemporary cybersecurity terminology. Orientation metaphors based on spatial axes and scales complement the overall picture. The "cybersecurity is movement" models (3 elements, for example: routing – routing, running, move), "direction" (3 terms, for example: backward channel, backward recovery) and "space" (32 units, for example: cyberspace, OSI environment, closed-security environment) form an idea of the dynamics, trajectories, and operating environment of digital systems. The above examples show that the "cybersecurity is movement" model focuses on data movement, packet transmission, and task execution in time and space, emphasising the activity and processability of information flows. The "direction" metaphor reflects the orientation in the logic of data flows and the ability to return the system to its previous state, which forms an idea of controlled correction and

recovery. The "space" model reveals the functioning environment of digital systems, their interdependence and security levels, which allows imagining cyberspace as a structured but dynamic environment where the movement and position of objects are of key importance.

Generalisation of the results obtained allows presenting metaphorical models of cybersecurity as a hierarchically organised and clustered system. At the upper level, there are three main types of metaphors – ontological, structural, and orientation, which form the macro level of conceptualisation. Within each type, thematic clusters are distinguished that are united by common source areas (war, medicine, architecture, nature, control, etc.). At a lower level, these clusters are implemented through submetaphores that specify certain aspects of cybersecurity (attack, protection, key, virus, data flow, etc.). Interaction between clusters has a network character: individual models (in particular, "cybersecurity is control, war, system") serve as nodes that integrate various conceptual projections and ensure the integrity of the term system. From a cognitive standpoint, the identified metaphorical models serve as conceptual schemas that structure knowledge about cybersecurity by transferring experience from specific areas to an abstract digital domain. In particular, the military model forms a conflict interpretation of cyberspace as a confrontation environment, where the key categories are threat, enemy, and defence. The control model provides insight into the manageability and manageability of information processes, while the container and space model organises an understanding of boundaries, access, and penetration. Together, these models implement basic cognitive conceptualisation mechanisms – objectification, structuring, and spatial organisation of knowledge, which allows interpreting cybersecurity as a systematic, dynamic, and controlled process.

The analysis shows that the conceptualisation of cybersecurity in English terminology is based on several basic cognitive mechanisms. Anthropomorphisation presents digital systems as objects with human properties, and reification (objectification) presents abstract processes as material objects under control. The conflict scheme structures cyberspace as an environment for countering threats and protection, spatial understanding reflects the boundaries, direction, and movement of information flows, and processalisation treats cybersecurity as a dynamic process of interaction and control. Together, these mechanisms form a cognitive model that provides interpretation of complex cyberspace phenomena through accessible human experience. The results obtained are consistent with the main provisions of the theory of conceptual metaphor. A significant contribution to its development was made by Z. Kövecses (2020), who proposed the concept of extended CMT. The researcher noted that metaphorical models are formed under the influence of physical experience, cultural models, social communication scenarios, and individual cognitive factors. He also emphasised the variability and contextual conditionality of metaphorical projections between domains of knowledge. This approach is consistent with the results of the current research, since the identified metaphorical models in the cybersecurity term system reflect not only universal cognitive mechanisms, but also the specifics of professional discourse and ways to conceptualise the digital environment.

Research has demonstrated the effectiveness of metaphorical models in various types of discourse. Corpus study by R. Abu Rumman *et al*. (2023) showed that metaphors play an important role in the translation and subtitles of audiovisual texts, where they can be stored or transformed depending on cultural and communicative conditions. The researchers proved that metaphorical structures are an important means of conveying conceptual content in cross-language communication. The results of the study support this conclusion, as they

confirm the universality of cognitive mechanisms of metaphorisation, which are manifested both in media discourse and in specialised terminology. Similar results were obtained by R. Khmelnytskyi (2024), who analysed the ontological metaphor "emotion is a substance in a container" in artistic discourse based on the material of the novel by F. Herbert "Dune" and its Ukrainian translation. The researcher has shown that such a metaphorical model provides effective verbalisation of complex emotional states through the image of spatial constraints and content. The researcher noted that ontological metaphors contribute to the conceptualisation of abstract psychological phenomena. This conclusion was confirmed by the results of the conducted study, which also demonstrated that ontological metaphors play an important role in structuring complex and abstract concepts in cybersecurity terminology.

Researchers paid special attention to the role of structural metaphors in the development of social and discursive narratives. T. Pasternak (2024) investigated the functioning of the military metaphor in media discourse and demonstrated its ability to conceptualise social processes through a model of struggle, confrontation, and strategy. The researcher stressed that such metaphors can influence the interpretation of socio-political events and the development of ideological frameworks. These results are largely consistent with the results the current research, because in the field of cybersecurity, metaphors of conflict, defence, and attack are also widely used to describe the interaction between subjects of the digital space. Metaphorisation of specialised terminology can also be traced in other areas of knowledge. The study by I. Sapozhnyk & T. Surodeikina (2025) analysed the metaphorical mechanisms of the development of English-language terms in the fields of art and commercial law. The researchers proved that metaphor is one of the key cognitive tools for expanding and systematising terminological systems. They also emphasised the role of interdisciplinary conceptual projects in shaping new meanings. The data obtained indicate in favour of this opinion, since the results of the current research confirmed that metaphorical modelling is an effective mechanism for conceptualising complex technical phenomena in the cybersecurity term system.

In the context of the study of metaphorisation of anthropomorphic concepts, the study by N. Yesypenko *et al*. (2022), devoted to the analysis of the metaphorical representation of anthropomorphic images in British and American fairy tales, deserves attention. The researchers have shown that anthropomorphisation is an important cognitive mechanism that allows transfering human properties to abstract or inanimate objects. The researchers emphasised that such metaphors contribute to the development of understandable cognitive models for interpreting complex phenomena. Although their research has focused on artistic discourse, its findings are partially consistent with the present results, since cybersecurity terminology also shows a tendency to anthropomorphise processes and systems (for example, describing programme actions or attacks as agent behaviour). Also of relevance is the study by O. Tur *et al.* (2025), which analysed the discursive features of the use of generative artificial intelligence terminology in professional communication. The researchers found that the development of new terminology in the field of artificial intelligence is accompanied by active processes of semantic expansion, metaphorisation, and adaptation of general language vocabulary. They also noted that metaphorical models help specialists to interpret complex technological processes and make specialised knowledge more accessible in professional discourse. These results are consistent with the findings of the current study, as it confirms the important role of metaphorical mechanisms in the development of contemporary technological terminology.

In addition, the development of metaphor research is actively supported by current approaches in computational linguistics. In particular, D. Wang *et al*. (2025) proposed the CKEMI model, a conceptually oriented automatic metaphor detection system that combines machine learning techniques with conceptual knowledge. The researchers proved that the integration of semantic and cognitive models increases the accuracy of recognition of metaphorical constructions in large text cases. Although their research was mostly technical in nature, its results confirmed the importance of conceptual analysis of metaphors for the further development of automated speech processing systems. Thus, the results of the study are generally consistent with the conclusions of contemporary scientific papers that consider metaphor as an important cognitive mechanism for conceptualising knowledge. The revealed interaction of ontological, structural and orientation metaphors in the cybersecurity term system confirms that metaphorical modelling plays an important role in shaping the professional picture of the world and in understanding complex processes of cyberspace. In this context, the metaphor acts not only as a language tool, but also as a tool for the cognitive organisation of specialised knowledge.

Conclusions

The study showed that metaphorisation is one of the key mechanisms for the development of contemporary English-language cybersecurity terminology. The analysis of the corpus of terminological units helped to identify a system of conceptual metaphors represented by three main types: ontological, structural, and orientation, which provide cognitive understanding of complex processes of functioning of cyberspace and information protection. The most productive were ontological metaphors (436 units), within which cybersecurity phenomena are conceptualised through specific objects and systems. Such models contribute to the objectification of abstract information security processes and their systematisation in professional terminology. In this type, cybersecurity is conceptualised as a material object, control, system, container, living being, or substance that allows capturing its properties, states, and internal organisation. The models "cybersecurity is control", "cybersecurity is a document", and "cybersecurity is a cipher" serve as the basis for forming terms for designating structural elements, security mechanisms, and vulnerabilities.

An important role in the term system under study is played by structural metaphors (416 units) that reflect the understanding of cybersecurity through other areas of human experience. The most representative model is "cybersecurity is military action", which is implemented through tokens to indicate attacks, threats, combat, and means of protection. Along with it, there are other conceptual models, in particular "cybersecurity is home", "cybersecurity is mathematics" and "cybersecurity is law", which reflect ideas about the structure, organisation and regulation of information security processes. Orientation metaphors (30 units) are represented by fewer examples, but they perform an important function of spatial and hierarchical structuring of concepts related to the threat level, degree of security, attack directions, and system boundaries. Thus, the contemporary English-language terminology of cybersecurity appears as a multi-level metaphorical system in which different types of conceptual metaphors interact and provide a cognitive interpretation of the processes of information security and countering digital threats. Prospects for further research are seen in an in-depth analysis of cognitive mechanisms for the development of metaphorical models in the cybersecurity term system and the study of their functioning in contemporary professional discourse.

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None.

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Концептуально-метафоричні моделі сучасної англомовної термінології кібербезпеки

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Анотація. Актуальність роботи зумовлена стрімким розвитком цифрових технологій і необхідністю лінгвістичного осмислення того, як спеціалізована термінологія формує професійну картину світу у сфері кібербезпеки. Метою дослідження було виявлення, систематизація та когнітивна інтерпретація концептуальних метафор у сучасній англомовній термінології кібербезпеки, а також визначення їхньої ролі у процесах концептуалізації цифрових загроз і захисних механізмів. Дослідження ґрунтується на положеннях теорії концептуальної метафори та спрямоване на виявлення механізмів мовної концептуалізації абстрактних процесів, пов'язаних із захистом інформації, управлінням цифровими загрозами та функціонуванням кіберпростору. Матеріалом даної наукової розвідки слугували 4 000 англомовних термінів, відібраних із авторитетного англо-українського словника термінів з інформаційних технологій та кібербезпеки. Методологічну основу становили когнітивно-метафоричний аналіз, семантична класифікація, компонентний і кількісний аналіз, що дозволило встановити ієрархію та продуктивність метафоричних моделей у досліджуваній термінології. У результаті аналізу термінів кібербезпеки встановлено, що їх значна частина сформована на основі концептуальної метафоризації. Найбільш продуктивними виявилися онтологічні метафори (436 одиниць), у межах яких кібербезпека осмислюється як контроль, система, шифр або контейнер зберігання даних. Значну групу становлять природні метафори, що включають моделі рідини, рослин і тварин, а також медичні метафори, пов'язані з концептуалізацією комп'ютерних вірусів. Серед структурних метафор (416 одиниць) домінує метафора «кібербезпека – це військові дії» (атака, загроза, боротьба, зброя), а також архітектурна модель «кібербезпека – це будинок» (ключі доступу, замки, шлюзи). Орієнтаційні метафори виявилися малочисельними і виконують переважно навігаційну функцію, забезпечуючи ієрархізацію понять ступіню загрози, рівня захищеності, векторів атак та меж системи. Практичне значення роботи полягає в можливості використання її результатів у дослідженнях когнітивної лінгвістики, термінознавства, дискурс-аналізу, а також у навчальних курсах і прикладних розробках, пов'язаних із цифровою комунікацією та інформаційною безпекою

Ключові слова: когнітивна лінгвістика; мовна концептуалізація; цифрові загрози; термін; образні моделі

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