

СТРУКТУРНА, ПРИКЛАДНА ТА МАТЕМАТИЧНА ЛІНГВІСТИКА

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AI-BASED ANALYSIS OF ENGLISH EMOTIONAL-STATE VERBS
IN LITERARY DISCOURSE

The article examines the semantic and contextual features of verbs expressing emotional states in English in literary discourse and the possibilities of their analysis using artificial intelligence. The study summarizes lexicon-based, machine learning, and hybrid approaches used in the automatic analysis of emotional lexicon, and evaluates the capabilities of modern NLP and AI models in detecting emotional units, semantic classification, frequency of processing, and determining contextual features. In literary texts, this concept is further expanded, because here the author's style, the characters' speech, narrative strategies, and the reader's interpretive activity interact with each other. The difficulties posed by ambiguity, metaphor, irony, and indirect emotional expression in literary discourse in automatic analysis are particularly emphasized. It is determined that although AI is an effective tool in the systematic analysis of emotional verbs, human verification of the results obtained from linguistic and philological perspectives is necessary. Expressing emotions through language is a pressing issue in modern linguistics. It has been established that in literary discourse, emotional meaning is formed not only by the semantics of individual words, but also by the interaction of narrative context, the character's psychological state, and the author's stylistic choices. Verbs expressing emotional states have been shown to play a significant role in representing the characters' inner worlds and constructing the emotional-semantic structure of the text. The study shows that verbs expressing emotional states play an important role in shaping the internal state of characters and the emotional-semantic structure of the text in literary discourse. Since the meaning of these verbs depends on the context, the lexical-semantic approach in their analysis should be complemented by discursive and contextual analysis.

Keywords: literary discourse, verbs denoting emotional states, emotional lexicon, artificial intelligence, automatic detection of emotions.

Introduction. The topicality of the research is determined by the connection of the possibilities of artificial intelligence and natural language processing with the linguistic analysis of verbs expressing emotional states in literary discourse. Although modern NLP systems allow for the automatic detection and classification of emotional units in large volumes of texts, context, ambiguity, metaphor, and irony complicate their analysis [11; 14].

The scientific novelty of the study is the connection of the traditional lexical-semantic and discursive analysis of verbs expressing emotional states with AI-based automatic analysis. Not only the emotional category of verbs is taken into account, but also their

contextual meaning, intensity, and function in presenting the emotional state of characters. The practical significance of the study is related to the demonstration of the possibilities of using AI tools in the analysis of the identification, classification, frequency of use, context, and collocative properties of emotional verbs in large-scale literary texts.

Analysis of Recent Research and Publications.**Analysis of the recent research and publication.**

There are many works devoted to this topic. We mainly rely on the works of authors such as Bodenheimer R., Burke M., Driver M., Ferré P., Sánchez-Casas R., Fraga I. and etcs. Literary discourse is considered as a specific textual activity that is carried out in



the unity of aesthetic, communicative and ideological functions. The concept of discourse is not limited to the text itself; it also includes the social, cultural and contextual environment in which the language is used. As noted in the Oxford Research Encyclopedia of Literature, discourse is understood as “language in use” and is formed and interpreted in socio-ideological contexts [10].

From this point of view, a literary text is not a set of separate language units; it emerges as the result of the interaction between the author's position, the narrative perspective, the characters' speech, the lexical-semantic and syntactic structure of the text, as well as the reader's interpretation. The analysis of literary discourse therefore requires not only the determination of the lexical meanings of language units, but also the investigation of what function they perform in a specific narrative context [16]. Studies in the field of stylistic and discourse analysis show that literary discourse encompasses both the internal organization of the written text and the semantic and pragmatic multiplicity of the text. M. Short's research emphasizes that discourse analysis is related to coherence, cohesion, and inference of meaning in written and oral texts [16]. One of the important features of the discourse approach to literary texts is that the language form has a functional character within the text. The choice of words and constructions in a literary work can be associated with revealing the character of the characters, evaluating events, forming a narrative perspective, and creating a certain emotional reaction in the reader. For this reason, in the linguistic analysis of literary discourse, the interaction of the formal features of the text with its semantic and pragmatic functions is considered one of the main issues [16; 17]. “The analysis of such cultures in the context of “discourse and culture” is one of the contemporary issues of linguistics” [15, p. 59].

Task statement. The purpose of the study is to identify the semantic and contextual characteristics of verbs expressing emotional states in English-language literary discourse and to explore the possibilities of their analysis using artificial intelligence.

Outline of the main material of the study. Literary discourse is a communicative field in which emotion is not only named, but also constructed using various linguistic and stylistic means. The emotional effect of a literary text can arise not only from lexical choice, but also from the interaction of syntactic, phonological and other formal features with the content [2]. One of the important components of literary discourse is the creation of emotional meaning. Emotion is not expressed in a work of art only through lexical

units that directly name emotions, such as love, fear, hate, grieve, rejoice; emotional effect can also arise as a result of the interaction of different levels of language. Burke, by examining the interaction of the formal and semantic features of the text in the formation of literary emotion, shows the importance of taking into account the relationship of language form with content in explaining the emotional effect of a literary text [2, p. 31-46].

P. Simpson shows that in his discursive stylistics approach, discursive analysis method is combined with rhetoric to reveal the emotional, ideological and perceptual layers of a literary text [17]. Therefore, when studying literary discourse, not only lexical units, but also the emotional and stylistic impact they create within the text should be taken into account. The relationship between discourse and emotion has also been formed as a separate research direction in modern linguistics. In the work *Emotion in Discourse*, edited by J. Mackenzie and L. Alba-Juez, emotion is considered as a multidimensional phenomenon that occurs at different levels of discourse [9]. One of the important features of literary discourse is subjectivity and polyphony. Studies on free indirect discourse show that in a literary narrative, the inner speech of the character, emotional color and the author's voice can be mixed together, which increases the functional load of verbs expressing emotional states [1, p. 706-709]. In this regard, literary discourse is a particularly suitable material for studying emotional content. Thus, within the framework of this study, literary discourse is considered as a multi-level communicative-textual system in which semantic and emotional meanings are formed between the author, the character and the reader through linguistic means. Verbs denoting emotional states act as one of the important lexical-semantic means in that system, serving to present the internal state of the characters, the emotional assessment of events and the formation of the general emotional tone of the text [2, pp. 31-46; 8].

Linguistic features of verbs denoting emotional states. Verbs denoting emotional states are lexical-semantic units that express a person's feelings, emotions, psychological reactions, and affective states. From a semantic point of view, verbs of this type can express a static emotional state, a sudden emotional change, or a cause-and-effect relationship of an emotion. As shown in studies devoted to the expression of emotions in language, units denoting emotions not only name a feeling, but also activate, direct, and mark it to varying degrees in context. Emotional verbs in English can be divided into various semantic groups: fear, joy, sadness, anger, surprise, disap-

pointment, excitement, etc. These verbs often have variable conjugation and, depending on the context, can indicate both the internal emotional state and the cause of that state. For example, some verbs express a direct emotional state, such as “feel”, “fear”, “panic”, “grieve”, “rejoice”, “mourn”, while others express an emotional effect on an object, such as “startle”, “comfort”, “frighten”. This shows that emotional verbs have not only a lexical but also a syntactic function.

The study of the differences between emotion-label words (words that name emotions) and emotion-laden words (emotionally loaded words) has been one of the most dynamically developing directions in recent years [13].

Recent studies on emotional words and emotion-label words show that emotional units are related to parameters such as prototypicality, arousal, valence, concreteness, and sociality [19]. This result proves the importance of studying emotional state verbs not only as semantic categories, but also within the psycholinguistic and discursive parameter system.

We can also ask artificial intelligence to present the conceptual and semantic differences of the terms Emotion-label and Emotion-laden or to present them in a table related to the mentioned parameters.

Expression of emotion through language. Emotion is expressed through language at different levels: lexical, grammatical, syntactic, prosodic and discursive levels. The emotional impact of a literary text can arise not only from lexical choice but also from the interaction of syntactic, phonological and other formal features with the content [2, pp. 31-46]. Lexical choices constitute the most important part of these means of expression in written texts. Emotion is conveyed both through direct naming and indirect description, metaphorical model, syntactic emphasis and narrative perspective. In literary discourse, the author can directly name an emotion, describe the character's internal state or indirectly present this state through behavior, speech, metaphor and context. Therefore, the difference between naming an emotion and indirectly presenting an emotion should be taken into account. For example, while in the construction “She feared him” fear expresses an emotional state directly, in the sentence “She shuddered when he entered the room” the emotional state is presented indirectly through a physical reaction. The distinction between direct naming of emotion and units that carry emotional meaning is an important theoretical issue for the analysis of emotional lexicon [13, pp. 147-164].

Studies on emotion-laden texts and words show that words with emotional content are processed differently in memory and perception than neutral words

and affect the interpretation of the text [4, p. 495-507]. Context plays a decisive role in the expression of emotion through language. The same lexical unit can have a different emotional function in different narrative situations. For example, the verb smile, although initially associated with a positive emotional reaction, can be used in a context expressing an ironic, coercive or even hostile attitude in a literary text. Therefore, when determining the emotional meaning, not only the lexical meaning of the unit, but also its immediate context and discursive function should be taken into account [13, pp. 147-164; 3, pp. 1071-1094].

However, in literary discourse, these units can become ironic, symbolic or a means of indirectly indicating the psychological state of the character. Therefore, emotional expression should be sought not only in the lexical meaning of the word, but also in its functional behavior within the text.

Recent studies also show that emotion has a dynamic and variable character in the language system. P. Wang and colleagues emphasize that emotions are not static during language use, but are formed within a situational and complex dynamic system [18]. This idea justifies the importance of analyzing emotional verbs in literary discourse in relation to individual character psychology, narrative development, and the overall emotional tone of the text. Application of artificial intelligence in linguistics. The application of artificial intelligence in linguistics covers the fields of automatic text processing, semantic classification, emotional analysis, discourse modeling, and natural language understanding. Modern NLP research shows that artificial intelligence systems are widely used to detect the emotional layer of texts, conduct research in the field of feeling and emotion detection (emotional orientation analysis - determining whether the text is positive, negative, or neutral; emotion detection - identifying specific emotions within the text: anger, sadness, joy, fear, etc.), as well as to find linguistic models (patterns) in large corpora. The review by J.Jim and colleagues systematically presents models, application areas, and challenges of sentiment and emotive tonality analysis [6]. In the review by J.Jim et al. the methods of initial data processing, the datasets used and the evaluation criteria, as well as approaches based on machine learning, deep learning, large language models and pre-trained models are systematically reviewed; the authors also identify the limitations of existing methods and the main problems of the field [6].

P. Nandwani and R. Verma also systematize the existing approaches, methods in the field of sentiment and emotion detection (sentiment and emotion analy-

sis), their application features and the main problems encountered in this field [11].

It would be wrong to approach the application of artificial intelligence in linguistics only as a technical tool. It also creates a theoretical methodological opportunity: it is possible to identify recurring emotional patterns in large volumes of texts, to reveal frequency and collocation relationships that human observation cannot reach. This feature is of particular importance for the automatic analysis of emotional verbs in literary discourse. Existing approaches to automatic analysis of emotional lexis. Automatic analysis of emotional lexis has developed mainly in three directions: lexicon-based approach, machine learning-based approach and hybrid approach.

In lexicon-based models, emotional values of words are assigned in advance and the text is analyzed based on those values. This approach is especially effective in the initial classification of emotional verbs. In the machine learning-based approach, the model learns emotional patterns from the corpus itself and performs the classification based on the context.

The hybrid approach tries to achieve higher accuracy by combining these two methods. Plaza-del-Arco and co-authors review 154 NLP studies published in the last decade, systematizing the tasks, emotional models, datasets, methods, and application areas used in automatic emotion analysis. The authors indicate that the main problems of the field include insufficient consideration of demographic and cultural factors, the incompatibility of existing emotional categories with some tasks, the lack of standardized terminology and the weakness of an interdisciplinary approach [14, pp. 5696–5710]. A. Koufakou and co-authors analyze existing datasets used for automatic emotion detection, showing that they differ in terms of emotional categories, text sources, and annotation features, and present a new benchmark called EmoBench for a more systematic evaluation of emotion detection models [8]. This is also relevant for the analysis of emotional verbs in literary discourse, since the semantic nuances of emotional units in literary texts are more complex. The contextual nature of emotional meaning poses an important methodological problem in the automatic analysis of literary discourse. Artificial intelligence and natural language processing systems should not be satisfied with the classification performed only at the word level when identifying emotional units, but should also take into account the contextual semantics of these units. In particular, polysemy, metaphorical use, irony, and indirect emotional expression are among the factors that complicate automatic classification [11; 14].

Studies on cross-lingual emotion detection show that language and cultural differences play a major role in the automatic analysis of emotional lexicon [20, p. 528]. This is especially important for literary discourse, since the same emotional verb can carry a different stylistic and semantic load in different textual traditions. Thus, existing approaches in the field of automatic analysis of emotional lexis create both a theoretical and practical basis for the study of literary discourse material. Artificial intelligence tools allow us to determine the frequency, context, collocative behavior and semantic network of emotional verbs. However, due to the multifaceted nature of the literary text, automatic results must necessarily be supplemented by human philological interpretation. “The influence of the digital environment on English is also evident in its interaction with cultural factors shaping linguistic discourse” [7, p.258].

The following steps can be used to conduct research:

1) Linguistic theoretical basis of the study. Before giving the query to the artificial intelligence, it is necessary to determine the classification of verbs: Semantic groups - group verbs according to types of emotions. For example, fear: *to fear, to shudder*; joy: *to delight, to exult*.

Aspectual properties: whether the verb is stative, i.e. indicating a state - *to love*, or dynamic, indicating a process - *to grieve*; plays an important role in artificial intelligence’s understanding of speech context.

2) Different artificial intelligence approaches are used to analyze verbs in literary texts. The first is sentiment analysis, i.e. the analysis of words that express feelings and emotions. VADER or BERT-based models measure the emotional tone of verbs in the text, whether positive, negative, neutral, or the intensity of the emotion. The second is LLM (Large Language Model): ChatGPT-4 or Claude can interpret hidden meanings, irony, and the inner world of which character the verb reflects in literary texts.

3) ChatGPT prompting algorithm for analysis. These step-by-step prompts can be used to extract and analyze emotional verbs from fiction text using artificial intelligence.

Step I: Finding verbs and context. “Identify verbs of emotional state in English from the following literary text. Show in a table which character each verb belongs to in the text and which emotion (fear, joy, sadness, etc.) it expresses”. Artificial intelligence provides more accurate and professional answers to academic queries in English. We can copy the literary text we want to analyze (for example, a chapter or fragment) and add it after these prompts. Prompt:

“Act as a computational linguist. Analyze the following literary text and extract all English verbs of emotional state (e.g., dread, yearn, rejoice, loathe). Present the results in a Markdown table with the following columns: 1) Verb, 2) Sentence context, 3) Semantic category of emotion (e.g., Fear, Joy, Sorrow, Anger), 4) Target character (who experiences the emotion). Here is the text: [ADD TEXT HERE]”.

Step II: Analysis of connotation and semantic nuances. “Is there a difference between the dictionary meaning of these verbs and their contextual meaning in the literary text? Explain from a semantic point of view why the author chose this particular verb (for example, the word dread instead of fear)” Prompt: “Analyze the extracted emotional verbs from the perspective of stylistic choice. Evaluate why the author preferred specific high-intensity or archaic verbs (e.g., 'dread' instead of 'fear', or 'yearn' instead of 'want') in this specific context. How do these verbs contribute to the characterization and psychological depth of the protagonist? Provide a nuanced literary and linguistic analysis”.

Step III: Identifying syntactic and lexical role. “Analyze the syntactic surroundings (collocations) of emotional verbs in the text. What adverbs are used with them and how does this increase their emotional intensity?” Prompt: “Examine the syntactic environment of the emotional verbs found in the text. Identify their typical collocations, such as modifying adverbs (e.g., 'bitterly wept', 'deeply dreaded') or prepositional phrases. Explain how these syntactic modifiers amplify or diminish the intensity of the emotional state within the discourse”.

4) Practical analysis of English-language literary texts using AI (Experimental Part). Advantages and challenges of artificial intelligence analysis.

1. Extraction and statistics of emotional verbs from a selected work using AI. Advantages: can scan thousands of pages of literary text (for example, all the works of Shakespeare or Dickens) in seconds and extract statistics of emotional verbs on demand.

2. Interpretation of contextual-stylistic and inter-personal analysis of verbs with AI. Challenges: AI can sometimes misinterpret the figurative meanings of irony, metaphors, or obsolete verbs in the text it provides. Therefore, the results provided by AI must be verified by a human (linguist).

As an option, we can also conduct research using other prompts (which can be translated into English):

A work of art (author, title of the work, source of the publication or electronic text, volume of the text in words or tokens, and the principle of text selection should be indicated) → a specific corpus → an SI model → emotional verbs (the main object of research should be clearly defined: it should be indicated in advance which verbs are considered emotional verbs and which are not included in the research. For example, only emotional-state verbs can be selected. Or verbs can be classified into the categories *Fear – Joy – Sadness – Anger – Love/Affection – Disgust – Surprise – Other*. Otherwise, the model may combine verbs belonging to different semantic classes into the same group) → semantic classification → frequency and percentage indicators of processing → contextual analysis of 10–15 most typical examples (direct expression of emotion; context-dependent change of meaning; high emotional frequency; metaphorical processing; irony) → verification of SI results and errors by the researcher (verification: number of examples correctly identified by SI; number of examples incorrectly identified by SI).

As a result, the following data is obtained:

1. Table showing emotional verbs and their frequency of use;
2. Table showing semantic categories and their percentages;
3. Table showing manual verification of SI results and detected errors;
4. Linguistic and discursive interpretation of 10–15 selected contextual examples.

Conclusions. Artificial intelligence provides broad opportunities for automatic detection, classification, frequency and collocative properties of emotional verbs. However, in literary texts, ambiguity, metaphor, irony and indirect emotional expression can limit the accuracy of automatic analysis. Therefore, it is important to verify the results obtained by AI with philological interpretation. Future research prospects are related to the analysis of larger literary corpora of different authors and genres, comparison of the results of different AI models and verification of automatic results with human expert annotation. In the future, a comparative analysis of emotional verbs in English with other languages is also appropriate.

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Заїрова Т. Д. АНАЛІЗ АНГЛІЙСЬКИХ ДІЄСЛОВ ЕМОЦІОНАЛЬНОГО СТАНУ В МИСТЕЦЬКОМУ ДИСКУРСІ З ДОПОМОГАЮ ШТУЧНОГО ІНТЕЛЕКТУ

У статті розглядаються семантичні та контекстуальні особливості дієслів, що виражають емоційні стани в англійській мові в літературному дискурсі, та можливості їх аналізу з використанням штучного інтелекту. У дослідженні узагальнено лексико-орієнтовані, машинно-навчальні та гібридні підходи, що використовуються в автоматичному аналізі емоційної лексики, та оцінено можливості сучасних моделей НЛП та ІІ у виявленні емоційних одиниць, семантичної класифікації, частоті обробки та визначенні контекстуальних особливостей. У літературних текстах це поняття додатково розширюється, оскільки тут взаємодіють стиль автора, мова персонажів, оповідальні стратегії та інтерпретаційна діяльність читача. Особлива увага приділяється труднощам, що виникають при автоматичному аналізі літературного дискурсу, пов'язаних із неоднозначністю, метафорою, іронією та непрямим вираженням емоцій. Встановлено, що хоча ІІ є ефективним інструментом у систематичному аналізі емоційних дієслів, необхідна людська перевірка отриманих результатів з лінгвістичної та філологічної точок зору. Вираження емоцій за допомогою мови є актуальною проблемою сучасної лінгвістики. Визначено, що у літературному дискурсі емоційне значення формується як семантикою окремих слів, а й взаємодією оповідального контексту, психологічного стану персонажа і стилістичних рішень автора. Дієслова, що виражають емоційні стани, відіграють значну роль у поданні внутрішнього світу персонажів та побудові емоційно-семантичної структури тексту. Дослідження показує, що дієслова, що виражають емоційні стани, відіграють важливу роль у формуванні внутрішнього стану персонажів та емоційно-семантичної структури тексту у літературному дискурсі. Оскільки значення цих дієслів залежить від контексту, лексико-семантичний підхід до їхнього аналізу слід доповнювати дискурсивним та контекстуальним аналізом.

Ключові слова: художній дискурс, дієслова емоційного стану, емоційна лексика, штучний інтелект, автоматичне розпізнавання емоцій.

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