DOI: 10.15587/978-617-7319-60-2.1

1 LEXICO-SEMANTIC GRAPHS AS FORMALIZED SCHEMES OF REFLECTION OF FRAGMENT OF REALITY IN HUMAN CONSCIOUSNESS

Anastasiia Kyrysiuk

ABSTRACT

This chapter formulates the main theoretical principles for the study of lexico-semantic field (LSF) and the principles of its construction. The feasibility of applying a formalized approach to the schematic representation of the structure of LSF in the form of lexico-semantic graph has been argued. Three stages of construction of a lexico-semantic graph with two vertices are characterized: PANDEMIC and PLAGUE. At the first stage, the semantic structure of the token *pandemic* in different explanatory dictionaries of the Ukrainian language is presented with the help of definitive analysis, synonyms for this keyword are selected and their semantic volume is determined. Based on the results of this procedure, a matrix of quantitative and qualitative indicators of a synonymous set of tokens of the keyword *pandemic* and its LSF was constructed, which turned out to be dual-core in its structure. The second stage involved the application of the method of component analysis with the determination of the seed composition of the lexical meanings of the keyword and its synonyms, the results of which are reflected in another matrix. The third stage of the research is to construct a model of the LSF graph with the vertices of *pandemic* and *plague*. The developed methodical algorithm allows to visually formalize the structure of LSF and the relationship between its core and periphery, as well as to measure the degree of semantic density of LSF elements.

KEYWORDS

Lexico-semantic field, matrix, graph, token, synonym, seme.

1.1 THEORIES OF LSF, THEIR CONCEPTUAL PROVISIONS AND DISCUSSION AROUND PRINCIPLES OF LANGUAGE UNITS' ORGANIZATION IN FIELD STRUCTURE

At the beginning of the XXI century, the rapid development of information technologies has led to new aspects in the study of language and thought processes associated with the creation of thought and word. The connections between units of language as a result of the creation of information by the brain began to be represented by graphs, i.e. as associative or semantic networks. Graph theory began to be developed by psycholinguists working on the discovery of the peculiarities of the mental representation of tokens and the relationship between them. The representatives of the theory of semantic memory and collectivism joined to them [1].

In linguistics (Fabian, M. [2], Peshchak, M. [3], Zasanska, N. [4], Eijck, J. [5], etc.) the idea of graphs united the following various directions: semantics, linguistics of text and discourse, terminology and translation studies, corpus linguistics. Such lexical resources as the British National Corpus, Wiktionary have become clear examples of the application of the method of graphs in the modern information space.

Nowadays the problems of studying automatic semantic analysis of the text, as well as the study of algorithms for reproduction and assimilation of new information, remain relevant. To solve them, scholars use various techniques, one of which is the process of constructing a lexico-semantic graph as a scheme for reflection various fragments of reality.

For the last two years, the world has been in a morally critical state caused by coronavirus disease (COVID-19), which has become a pandemic. In the linguistic consciousness of Ukrainians, it is already outlined by this token and its synonyms. The study of the units that organize the lexico-semantic field of the pandemic, as well as the presentation of the results of their connections with the help of a graph, will illustrate linguistic and extralinguistic knowledge of all tokens that objectify the notion of *pandemic* in Ukrainian linguistic culture.

Kucher, I. [6] writes that the organization of knowledge about reality was tried to be represented as a field structure (Trier, J. [7], Ipsen, G. [8]). Later the following notions have been chosen for this concept: semantic field (Robbins, R. [9]) and lexico-semantic field (hereinafter – LSF) (Ufimtseva, A. [10]).

Trier, J. [7], the German scholar, is the founder of the theory of the semantic field. He argues that all concepts in language by similarity or contrast are divided into more or less closed "blocks" (groups). In each of them the notion (meaning) exists only due to the presence of lexical connection in its structure, correlation with other notions (meanings). If a notion (meaning) is removed or changed from a "block" (group), it causes a change and restructuring of all its constituents, and sometimes the decline of some of them and the emergence of new notions (meanings). Thus, Trier, J. [7] called a group of elements with a corresponding set of connections and changes a conceptual, or semantic field. The totality of all fields constitutes the lexico-semantic system of language [11].

Ibsen, G. [8] was the first to consider the semantic field as a set of tokens that have a common meaning. Selivanova, O. who quotes the scholar, notes that one semantic group is formed only by equally designed and related words, i.e. those that have a common morphological design due to their semantic proximity [12].

Early notions of semantic fields had a predominantly subjective approach that is why they could not cover the entire lexical structure of language. Nevertheless, it became the impetus for research on the theory of LSF (Ufimtseva, A. [10]), which began to be developed directly by linguists (Robins, R. [9], Vasiliev, L. [13]).

Modern linguistics does not have an unambiguous interpretation of the terms *semantic field* and *LSF*. Most linguists consider them to be synonyms and use one notion to mean another, as well as they consider both terms interchangeable. Kucher, I. supposes that the broadest understanding of the term semantic field is given by Vasiliev, L. [13], who includes semantic classes

(groups) of words of a certain part of speech, semantically related classes (groups) of words of different parts of speech, lexico-grammatical (functional-semantic) fields, paradigms of syntactic constructions connected by transformational (derivational) relations, and different types of semantic-syntactic syntagms [6].

With regard to LSP, the situation is more predictable, because some scholars [11, 14] do not deny that its structure has a complex hierarchical organization with the centre (core) and periphery, which are in constant interaction. The frequency of field elements should be considered when determining the centre and periphery of the LSF. Accordingly, the core consists of the most commonly used tokens (set of lexico-semantic variants), i.e. carriers of basic meanings that most fully express the essence of the field, and the periphery consists of units that are distant from the name of the field and may be included in other semantic fields, i.e. stylistic synonyms, dialects etc. [14, 15].

However, the discussion on the criteria for the affiliation of units to the structure of LSF is still not exhaustive. Ivanenko, N. [16] notes that integrity, orderliness, continuity, blurred borders are included into the list of features of LSF by some linguists (Nikitin, M. [17]). It should be included in fields of a token of only one morphological class, narrowing this list, meanwhile the others (Matsuk, A. [18]) defend the expediency of including words from different parts of speech.

Kochergan, M. [19] says that the paradigmatic relations that exist in the lexical-semantic system of language are to be considered while determining the LSF. Accordingly, LSP is a set of paradigmatically related lexical units that have the unity of content (combined and common formal indicators) and reflect the conceptual, substantive and functional similarity of the denoted phenomena.

Given the stated positions of scholars, we provide a refined definition of the structure of LSF, which is a semantic-paradigmatic nuclear-peripheral formation with zones of semantic intersections. It follows that the units in the structure of LSF should be organized on the basis of the following three principles:

1) *semantic* (tokens are selected on the basis of common meanings, which through component analysis are combined on the basis of archetypes);

2) *structural* (formation of the core, centre and periphery of the LSF);

3) *systemic* (establishment of hyper-hyponymic, synonymous, antonymous, polysemantic and other relations in the studied LSF).

1.2 FORMALIZED METHODS FOR STRUCTURING LSF MODELS

Various formalized methods, including field, hierarchical, etc., can be used to study LSP.

According to the observations of Boyko, N. [20], the field approach to the study of vocabulary allows to systematize language phenomena in the core-peripheral organization and trace the contextual implementation of their semantic connections and modifications [20]. Recently [21], this approach is used in combination with other formalized methods. For example, while studying the composition, structure and semantics of the LSF *Патріотизм* (lit. *Patriotism*) in the Ukrainian,

English and Polish languages, as a result of the involvement of an additional procedure of matrix modeling, semantic matrices of both the field itself and its microfields were built.

Golovashchenko, Yu. [22] proposed a detailed methodical algorithm for hierarchical modeling of LSF of a specific conceptual field in her work. The scholar considers the first (higher) level of LSF to be the lexicosemantic microfield, which involves the division of a wider conceptual field into smaller adjacent areas. The lexicosemantic microfield is divided into semantic subclasses, i.e. groups based on common semantic-morphological features. The lower hierarchical level of LSF is the lexicosemantic group (hereinafter – LSG), which reflects the intra-linguistic connections between the lexical meanings of words. The inclusion of lexical units in the composition of LSG occurs on the basis of the available dominant seminal component. It allows assigning a certain meaning of the word to the corresponding sphere of extra-linguistic reality. The inventory of LSG units is based on the analysis of dictionary definitions.

A similar algorithm was used to construct the LSF *Простір* (lit. *Space*) [23], which includes the following stages:

1) determination of the center of the LSF, hyperonym, archilexeme;

2) etymological and component analysis of the key word, i.e. the name of LSP and its synonyms, among the values of which hierarchical relationships are also established.

These preliminary observations on the efficiency of the application of formalized methods in the most modern linguistic works allow us to draw preliminary conclusions that their shortcoming is the lack of proposed criteria for a clearer demarcation of units of the LSG, i.e. the components of a certain LSF located on its peripheral zone (for example, on the near and the far periphery). This deficiency can be compensated for by involving the elements of mathematical theories of sets and graphs tested in this study.

In general, the origins of this formalized approach to the analysis of linguistic data material go back to the studies of the employees of the Department of Structural and Mathematical Linguistics of the Institute of Ukrainian Language of the National Academy of Sciences of Ukraine under the leadership of Peshchak, M. [3]. Later, it was tested in individual studies of Ukrainian linguists (Hertsovska, N. [24], Fabian, M. [2], Klymenko, N. [3], Lyashuk, A. [25], Zasanska, N. [4]). In order to ensure the clarity and step-by-step structuring of knowledge about a fragment of reality in the form of LSF, these scholars suggest combining the field approach with the procedures of graph theory.

Below we present the step-by-step algorithm of the formalized approach developed by us with elements of the matrix modeling procedure, field organization of LSF units and graph theory for building the lexicosemantic graph *Pandemic*.

1.3 STAGES OF APPLICATION OF THE COMPLEX METHODOLOGY OF BUILDING THE LEXICOSEMANTIC GRAPH PANDEMIC

At the first stage, with the help of definitional analysis, we present the semantic structure of the token pandemic is to be represented from the various explanatory dictionaries of the

Ukrainian language, synonyms for this keyword are to be chosen, as well as their semantic scope is to be determined. Definitional analysis allows one to correlate the meanings of lexical items with the help of dictionary interpretations. The study of lexical meaning by definitions and its lexicographic presentation allows to establish the nature and types of semantic structure of words belonging to different semasiological sub-classes and semantic categories, i.e. to consider the lexical meaning of a word in terms of its epidigmatics [10].

The study of vocabulary on the basis of explanatory dictionaries contributes to a deeper analysis of the specific features of tokens. The dictionary article mainly reflects the semantic structure of the word in detail that is why relying on the definition of an explanatory dictionary makes it possible to recognize similarities and differences of lexical units based on common and differential elements of definitions, process a large number of linguistic units and analyse all components [21, 26]. It is believed that every explanatory part of the dictionary entry represents the meaning of the lexical unit as a set of semantic components, where each element of the dictionary interpretation is equated to seven (Ivanenko, N. [16], Luchyk, A. [27], Lyashuk, A. [25]).

Dictionary entries are compared according to the set theory. Element-by-element sections of their composition are detected. Groups that form synonyms at the lexical level are formed at the intersection of one dictionary entry with several others. The sequence of distributions of intersections determines the different number of groups that is why it is possible to describe the relationship between dictionary entries and place them in order in the semantic field [3]. Based on the identified differential elements of the compared entries, classes that do not intersect and are characterized by individual semantics are identified. The size of such a class is determined by the number of common and distinct formal features by which it is distinguished from the array. Therefore, the fewer formal features underlying the allocation of a class, the larger its size will be. Thus, the class is considered to be "a set of elements with a quantitatively limited number, and groups are their topographically ordered list on a set-theoretic basis" [3].

The structure of a dictionary entry means a set of organized formal features, the number of which is mainly related to the degree of polysemy of the word: the more lexical meanings, the more vividly revealed formal features of a dictionary entry [3]. The relationship between the formal features reflects the peculiarities of the organization of the dictionary entry, as well as it reveals the ambiguity of the lexical unit. The connections between the constituent elements of an explanatory entry are interdependent and interrelated. This makes the dictionary article integral for the classification of LSF units by formal features. The degree of affinity between explanatory entries is a formal manifestation of the affinity of tokens.

A dictionary entry is a set of formal features with an established structure, where the addition or removal of data material changes other parts of the article and its regrouping in general.

Then the resulting sets of lexical units are formed into sets based on the theoretical-plural approach. According to Cantor, G. [28], the founder of the "set theory", a set is a group of certain objects that is perceived as a holistic formation [29]. In this case, a set is a collection of linguistic objects that are united by a certain feature.

All elements of the set, which have specific properties, are in different aspects of each other. Therefore, the elements of sets are further gradually stratified into subsets, i.e. groups of the most significant tokens and units with a medium degree of polysemy. The division of a set of elements into subsets is consistent through the study of their content, which is represented by a certain set of semantic features. It is important to keep in mind that each unit can appear in the plural only once (Hertsovska, N. [24], Fabian, M. [2]).

By gradually reducing general and complex notions to simpler ones, it is possible to represent the features of these elements in more detail. On the other hand, through the disclosure of semantic features and relationships between the elements of the set, it is possible to identify and cover the entire structure of LSF.

The analysis of lexical units that denote fragments of reality is done by identifying and repeating the same semantic features. According to the multilevel classification, tokens form subsets, i.e. their elements have other meanings, in addition to the basic meaning. Due to it, the subsets intersect with other subsets and form a theoretically infinite macro series.

The result of the definitional analysis is a constructed matrix, which is represented in the form of a table as a model of the system of semantic connections and semantic structure of vocabulary. In columns and rows of equal length, the ratios of words and their meanings are marked with a "+", as well as semantic connections between the studied tokens are fixed. According to Kochergan, M. [30], if we imagine lexico-semantic fields as matrices, the number of cells of any field in two languages will never match, not all cells in the compared languages will be filled, and that that in one language is contained in one cell, in another can be distributed between two or more smaller cells.

With the help of the constructed matrix it is possible to study the nuclear-peripheral structure of LSF and to trace all the features of its structure: realized relations between units (filled matrix cells) and implicit capabilities (unfilled cells). Representation of lexical units of the field as a matrix illustrates their semantic structure, types of meanings, relationships between word meanings, ways of transition from one meaning to another (Kochergan, M. [14, 19, 30], Luchyk, A. [27], Fabian, M. [2]).

The study of the ratios of the meanings of the language units of LSF confirms the semantic regularity, i.e. the place of a word in the matrix depends on the number of its meanings. That is why, polysemy is a classification category, which is based on a "net" of relations of lexico-semantic variants that reflect various objects and phenomena of the world. Each field token takes its place, which is determined by quantitative (degree of polysemy) and qualitative (semantic potential for the expression of the notion of *pandemic*) criteria.

Thus, the structure of LSF depends on the degree of ambiguity of its units: tokens with the highest degree of polysemy belong to the core of the field, with medium degree of ambiguity – to the main syllable, and tokens with the lowest degree of polysemy form the periphery (Fabian, M. [2], Hertsovska, N. [24]). Systematic analysis of polysemous units clarifies the principles of creating new meanings of tokens and the internal structure of the set, which is revealed through the relationship between its elements and other elements of LSF.

The semantic analysis of language data material indicates the importance of the transitions of meanings between lexical units. It is manifested in the ability of tokens to be used in different contexts that are combined with different parts of speech, gain or lose certain meanings. National, cultural, historical, social features of the perception of fragments of reality by native speakers are reflected at the heart of these transitions. According to the results of the analysis of LSF units, the dynamism and intensity of transitions is observed mainly between language units with a high and medium degree of polysemy. These relationships are found in the LSF matrix, where tokens with a high degree of polysemy occupy a densely filled part, and tokens with the least number of meanings – sparsely filled places.

Therefore, due to the structure of the matrix, every unit of LSF is represented in indirect and direct connections. Indirect connections have a more complex structure and represent relationships between units as chains, where one element is connected to another through two, three or more elements. Paradigmatic connections are revealed through the same components in the meanings of different tokens. That is why, the presence of common meanings in the interpretations of different words makes the analysed language units paradigmatically correlated. The analysis of paradigmatic relations takes into account the relationships between field units, their interdependence and oppositional relationships. Due to the fact that the same word is able to form different opposition ties, a holistic paradigmatic structure of LSF is built.

We will demonstrate this with the example of the token *pandemic* as the name of LSF.

First, the meanings of the token *pandemic* are written from the explanatory dictionaries of the Ukrainian language. Five dictionaries of the Ukrainian language are involved for interpretation:

1. Dictionary of the Ukrainian language: in 11 volumes (Bilodid, I. 1970–1980) [31].
2. Dictionary of the Ukrainian language: in 20 volumes (Rusanivsky, V. 2010) [32].
3. Dictionary of foreign words (Melnychuk, O. 1974) [33].
4. Large explanatory dictionary of the modern Ukrainian language (Busel, V. 2005) [34].
5. Encyclopaedia of Modern Ukraine: electronic version (eds: Dziuba, I., Zhukovsky, A., Zheleznyak, M., etc.) [35].

However, there is no information about the *pandemic* in the latter. The synonyms to the word *pandemic*, available in the Dictionary of Synonyms of the Ukrainian language by Vusyk, O. [36], were singled out, as well as their meanings were considered.

The collected data material is represented in the form of a matrix (**Table 1.1.1**). In order to model a matrix with LSF of *pandemic*, Microsoft Excel, the programme for creation of spreadsheets, is used. It provides ample opportunities for organizing and analysing data: organizing synonyms and their meanings into hierarchical lists, making changes as needed and tracking changes in the field that cause them, using filters to make automatic token samples to analyse individual parts of the field. In further research, such a matrix or its fragments can be transformed into various graphs, charts, etc. It will also be easy to add new elements to the matrix or automatically combine matrices of different LSFs, which will make the study of the whole lexical system of language more productive.

Table 1.1.1 Quantitative and Qualitative Indicators of Synonyms for the Keyword of *Pandemic*

No.	The meaning of tokens	Synonyms taken from 5 explanatory dictionaries of the Ukrainian language*						
		Pandemic	Plague	Infection	Epidemic	A kind of plague	Panzootia	Mor
1	2	3	4	5	6	7	8	9
1.	"Infectious disease / illness"	+ (3)			+ (3, 5)			
2.	"Contagious disease / illness of humans or animals"		+ (1, 4)					
3.	"Infectious animal disease / illness"						+ (3)	
4.	"The highest degree of the disease / illness"	+ (3)						
5.	"The highest degree of epidemic"	+ (1)						
6.	"Extremely strong epidemic"	+ (2)						
7.	"The highest level of epidemic process development"	+ (2)						
8.	"Covers the majority of the population of a country or several countries"	+ (1, 2, 3, 4)						
9.	"Mass spread of the disease / illness"		+ (1, 4)		+ (3)		+ (1, 2, 4)	
10.	Figurative meaning "extremely fast spread of something"				+ (1, 2, 4)			
11.	"Progresses in time and space within a specific region"				+ (5)			
12.	"Epidemic"		+ (1, 4)	+ (1, 4)		+ (1, 4)	+ (1, 4)	
13.	Figurative meaning "evil"		+ (1, 4)					

● **Continuation of Table 1.1.1**

1	2	3	4	5	6	7	8	9
14.	Figurative meaning "misfortune"		+ (1, 4)					
15.	Figurative meaning "adversity"		+ (1, 4)					
16.	Figurative meaning "systematic recurrence of the phenomenon"		+ (1, 4)					
17.	"Microorganisms that cause infectious diseases / illnesses"			+ (1, 4)				
18.	"Pathogenic principle spread by microorganisms"			+ (2)				
19.	Figurative meaning "something negative that can spread, worry"			+ (1, 4)				
20.	Colloquial "pejorative"			+ (1, 2, 4)				
21.	"Horrible death"							+ (1, 2, 4)
22.	"Plague"							+ (1, 2, 4)
23.	"Plague" (Ukrainian "чума")					+ (1, 4)		
24.	"Causes high mortality"					+ (1, 4)		

** Explanatory dictionaries of the Ukrainian language:*
1. Dictionary of the Ukrainian language: in 11 volumes (Bilodid, I. 1970–1980).
2. Dictionary of the Ukrainian language: in 20 volumes (Rusanivsky, V. 2010).
3. Dictionary of foreign words (Melnychuk, O. 1974).
4. Large explanatory dictionary of the modern Ukrainian language (Busel, V. 2005).
5. Encyclopaedia of Modern Ukraine: electronic version (eds: Dziuba, I., Zhukovsky, A., Zheleznyak, M., etc.).

The Matrix (**Table 1.1.1**) shows the ratio of synonyms and their meanings. 24 meanings were singled out among 6 synonyms for the keyword *pandemic*.

It should be noted that in the matrix the densely filled left corner is occupied by the keyword *pandemic* and the most significant units. Tokens with a medium degree of polysemy are located in the middle of the matrix, and with the least number of values – on the right. It should be noted that all 6 synonyms are ambiguous.

The token *plague* is updated with the largest number of meanings. It has seven definitions and it is interpreted through direct meanings ("infectious disease of humans or animals", "mass spread of disease", "epidemic") and figurative ("disaster", "trouble", "attack", "systematically recurring phenomenon"). All meanings of the analysed token are equally represented in dictionaries 1 and 4, but none of these meanings coincides with the meaning of the keyword *pandemic*, represented in 1–4 dictionaries.

The meaning of the token *pandemic*, which "covers the majority of the population of a country or several countries", is the same in all dictionaries (1–4), where the analysed token is represented. It should be noted that all keyword meanings are direct.

We observe the discovery of the peculiarity of the token *infection* in that it has not only direct meanings, but also figurative ("something negative that can spread, worry"), which is listed in dictionaries 1 and 4, and it is also used as a swear word in colloquial speech, which is reflected in three dictionaries – 1, 2 and 4.

The peculiarity of the synonymous token *panzootic* has the following meaning: "infectious disease of animals", which is reflected in the dictionary 3.

We note that all interpretations of the synonymous token *a kind of plague* (Ukrainian *моровиця*) are equally represented in two dictionaries – 1 and 4 and have a direct meaning. The meaning of "mass spread of the disease" is the same for the tokens epidemic, panzootia, plague. We emphasize that the definitions of tokens are represented in different dictionaries.

The tokens plague, infection, plague 2, panzootia have one common meaning – "epidemic", which is equally recorded in two dictionaries – 1 and 4.

Thus, according to the number of meanings of synonymous tokens, the studied LSF is considered to be a complex hierarchical structure (**Fig. 1.1.1**), which has two nuclei (*plague*, *pandemic*), perinuclear zone (*infection*), near periphery (*epidemic*, *a kind of plague*, *panzootia*) and far periphery (*mor*).

In the second stage, with the help of componential analysis, the seme organization of the units of the studied LSF is determined and the second matrix is built (**Table 1.1.2**).

Componential analysis is one of the most effective methods of the structural method and in general the study of language semantics (Kochergan, M. [14, 19, 30], Luchyk, A. [27]). Its essence is to split the lexical meaning of the word into seven. And their limited number makes it possible to describe and systematize the entire lexico-semantic system of language [27].

At this stage of the study, the result of the componential analysis is represented in the form of a matrix (**Table 1.1.2**), in which vertically we place the seme syllable, and horizontally – synonyms and components of their meanings.

We note that all synonyms of LSF of *pandemic* are united by one archetype 'disease / illness'.

The greatest semantic volume is observed in the synonymous token *plague*. However, as it is shown in **Table 1.1.2**, the meaning of the keyword *pandemic* (6 meanings) and its synonymous unit *plague* do not intersect, i.e. none of the meanings of the synonymous token *plague* is characteristic of the keyword *pandemic*. But their synonymy is proved by the existence of a common archetype 'disease', an integral seme 'type of disease' as a component of the meaning (1) of the token *pan-*

demic and the meaning (2) of the token *plague*. We also note that the meanings (5 and 6) of the keyword show semantic relationships with the meaning (12), characteristic of the synonymous token *plague*, which are united by the gradual seme 'spread of disease' (from the meaning of "epidemic" (typical for *plague*) to the meaning of "the highest degree of epidemic", "extremely strong epidemic" (*pandemic*)). Based on the proven semantic relations, we consider the tokens *pandemic* and *plague* to be complete synonyms.

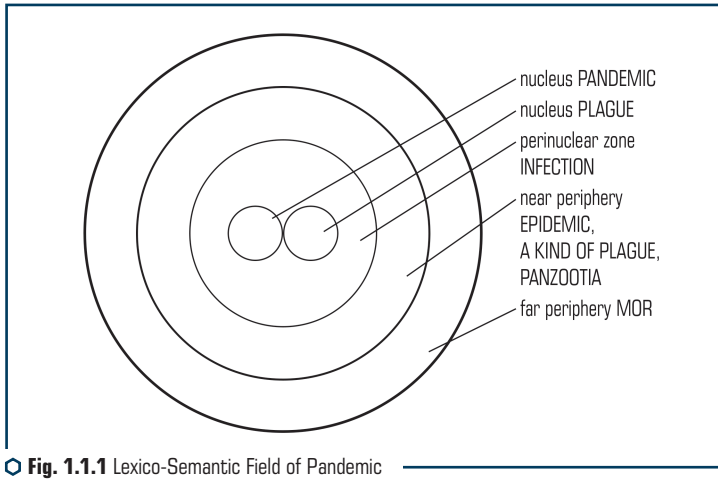


Fig. 1.1.1 Lexico-Semantic Field of Pandemic

The tokens *plague 2*, *panzootia*, and *contagion* also enter into semantic relations by meaning (12), which is expressed by the gradual seme 'degree of spread of disease' and proves their synonymous nature.

According to quantitative and qualitative indicators, a synonymous token of *infection* is assigned to the perinuclear zone (3). However, as we can see, it is combined with other elements of the field (*plague* (2), *epidemic* (4), *panzootia* (6)), in addition to the archetype, the integral seme 'space of spread of disease / illness', because characteristic of that token is that it has a figurative meaning (19) and is used as a swear word (20).

Synonymous relations based on the commonality of the integral seme 'type of disease' can be traced between the tokens *pandemic*, *plague*, *epidemic*, *panzootic*. Synonymous tokens *epidemic* and *plague* are united by the integral seme 'time of spread of the disease', but have different differential semes. Thus, the differential seme 'time of spread of disease (of humans / animals)' is a component of the meaning of the token *plague*, and 'time of spread of disease (people)' is a component of the meaning of the token *epidemic*.

The synonymous token *mor* belongs to the extreme periphery, because it has the smallest number of meanings (only 2 – "terrible death", "plague"), and therefore it enters into semantic

relations only with the synonymous token a kind of plague. They are united by the integrated seme 'quality of disease / illness' and its differential seme 'deadly disease / illness'.

Based on the interpretations of the meanings, we single out the integrated seme 'pathogen', which has no relation to other units of LSF and 6 different differential semes, which are characteristic of only one synonymous word: 'space of spread of disease (of people / animals) (plague), 'space of spread of disease / illness (of people)' (*epidemic*), 'space of spread of disease / illness (of animals)' (panzootia), 'infectious disease / illness (of humans / animals)' (plague), 'degree of spread of disease / illness (of humans / animals)' (plague), 'degree of spread of disease / illness (of animals)' (panzootia).

At the third stage, based on the results of the constructed matrix, we are to model the graph with LSF. According to the graph theory, every unit of the field enters into hierarchical connections and relations with other elements of the field. Thus, we trace the features of the external structure and internal system organization of the studied LSF, qualitative and quantitative semantic properties and the laws of their formation in the Ukrainian language.

● **Table 1.1.2** Matrix with Lexico-Semantic Field of *Pandemic*

No.	Seme composition of synonymous words	Synonyms and components their meanings						
		Pandemic	Plague	Infection	Epidemic	A kind of plague	Panzootia	Mor
1	2	3	4	5	6	7	8	9
1.	**Archiseme 'disease / illness'**	+	+	+	+	+	+	+
1.1.	**Integral seme 'type of disease / illness'**	+	+		+		+	
	Differential semes:							
1.1.1.	'infectious disease / illness (of humans / animals)'		+					
1.1.2.	'infectious disease / illness (of humans)'	+			+			
1.1.3.	'infectious disease / illness (of animals)'						+	
1.2.	**Integral seme 'quality of disease / illness'**					+		+
1.2.1.	**Differential seme 'deadly disease / illness'**					+		+
1.3.	**Integral seme 'pathogen'**			+				
1.4.	**Integral seme 'space of spread of disease / illness'**		+	+	+		+	
	Differential semes:							
1.4.1.	'space of spread of disease / illness' (of humans / animals)'		+					

Continuation of Table 1.1.2

1	2	3	4	5	6	7	8	9
1.4.2.	'space of spread of disease / illness' (of humans)'				+			
1.4.3.	'space of spread of disease / illness' (of animals)'						+	
1.5.	**Integrated sema 'time of spread of the disease / illness'**		+		+			
	Differential semes:							
1.5.1.	'time of spread of disease / illness (of humans / animals)'		+					
1.5.2.	'time of spread of disease / illness (of humans)'				+			
1.6.	**Gradual sema 'degree of spread of the disease / illness'**	+	+		+	+	+	
	Differential semes:							
1.6.1.	'degree of spread of the disease / illness (of humans / animals)'		+					
1.6.2.	'degree of spread of the disease / illness (of humans)'	+			+			
1.6.3.	'degree of spread of the disease / illness (of animals)'						+	

The lexico-semantic graph illustrates the degree of ambiguity of LSF units: the tokens with the largest number of meanings are located in the centre (vertices of graphs) and are combined with other units by means of arcs. Through semantic analysis of all elements in the arc of the graph (from the vertex to the final semantic node) reveals the semantics of each word LSF [4].

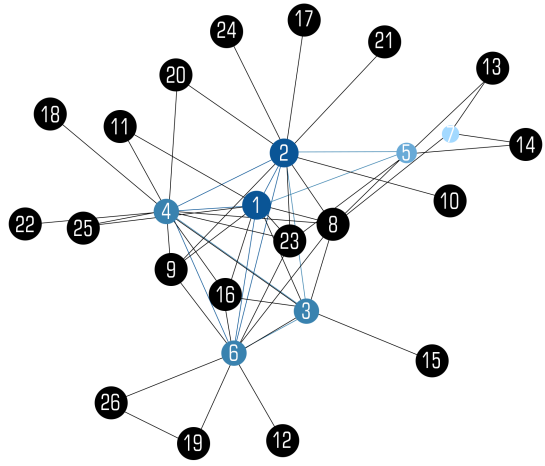
We model the lexico-semantic graph of the pandemic with the help of the Gephi programme, developed by the students at the French Compiegne University of Technology (UTC) in 2009 [37]. This tool allows one to build graphs with hundreds of thousands of vertices and connections.

We enter information about the vertices and edges of the future graph into the programme. Gephi has different layout algorithms and allows one to customize the colours and labels in the column, which we use. Black colour represents the semantic composition of synonymous words, shades of blue highlight synonyms and components of their meanings. Colour saturation depends on the number of semantic connections of the synonymous word and the components of its meaning with other field units. The same trend is observed in the edges of the graph: the units of LSF that are united by the largest number of semantic relations are connected by bold edges, and those with the smallest number are barely visible on the graph. Black arcs show the connection between synonymous words and their semantic composition.

Representation of the external structure of the LSF of *pandemic* in the form of a graph (**Fig. 1.1.2**) shows that the analysed field has a compact polycentric structure with distinct centres. It should be noted that the tokens *plague* (2) and *pandemic* (1) are located on the graph next to each other, have the largest size and are depicted in the darkest shade of blue.

We explain this by the fact that these tokens are the centre of LSF and have a large number of semantic relationships with other units of the field: plague – 9, pandemic – 5.

The opposite of the centre of the field is its far periphery. We observe that the word-synonym *mor* (7) is almost invisible on the graph: it has a light centre and the same arcs, because they are connected with other units of the field only by a common archetype, and integral seme 'disease / illness quality' and differential seme 'deadly disease / illness' – only with the synonymous token *plague* (5).



1 – pandemic; 2 – plague; 3 – infection; 4 – epidemic; 5 – a kind of plague; 6 – panzootia; 7 – mor; 8 – archiseme 'disease / illness'; 9 – integrated sema 'type of disease / illness'; 10 – differential sema 'infectious disease / illness (of humans / animals)'; 11 – differential sema 'infectious disease / illness (of humans)'; 12 – differential sema 'infectious disease / illness (of animals)'; 13 – integral seme 'quality of disease / illness'; 14 – differential seme 'deadly disease / illness'; 15 – integral seme 'pathogen'; 16 – integral seme 'space of spread of disease / illness'; 17 – differential sema 'space of spread of disease / illness' (of humans / animals)'; 18 – differential sema 'space of spread of disease / illness' (of humans)'; 19 – differential sema 'space of spread of disease / illness' (of animals)'; 20 – integrated sema 'time of spread of the disease / illness'; 21 – differential seme 'time of spread of disease / illness (of humans / animals)'; 22 – differential seme 'time of spread of disease / illness (of humans)'; 23 – gradual seme 'degree of spread of the disease / illness'; 24 – differential seme 'degree of spread of the disease / illness (of humans / animals)'; 25 – differential seme 'degree of spread of the disease / illness (of humans)'; 26 – differential seme 'degree of spread of the disease / illness (of animals)'

Fig. 1.1.2 The lexico-semantic graph of the pandemic

CONCLUSIONS

Early concepts of semantic fields had a mostly subjective approach. They could not describe the entire lexical structure of the language, but began to develop the theory of LSF by linguists.

Despite the different approaches of scholars to the interpretation of the concept of LSF, all of them are united by a common vision of this formation as a model of nuclear-peripheral organization of language units with a common archetype. Traditional structural semantics distinguishes three principles in the construction of LSF: semantic, structural and systemic.

The developed method of formalized research of LSF pandemic provides a comprehensive approach to the study of its structure and consists of three main stages. At the first stage, 6 synonymous tokens were selected for the keyword *pandemic* and their meaning was explained.

In the course of the research it was established that each word is ambiguous. We trace the common values of synonymous tokens with the help of matrix 1 and fix that the token *plague* with the largest number of meanings (7) does not coincide with any meanings (6) of the keyword *pandemic*. According to quantitative and qualitative indicators in LSF we distinguish two nuclei (plague, pandemic), perinuclear zone (infection), near periphery (epidemic, a kind of plague, panzootia) and far periphery (plague) and show this in **Fig. 1.1.1**.

In the second stage, the component analysis is performed and the matrix 2 is constructed.

In the process of studying the relationship of language units in the system of the analysed field, we conclude that the archetype 'disease / illness' unites all synonymous tokens LSF *pandemic*. By identifying the semantic relationships between the tokens *pandemic* and *plague*, we prove that they are complete synonyms, because they have a common archetype 'disease / illness', integral seme 'type of disease / illness', and the meaning (5 and 6) of the keyword show semantic relationships with meaning (12), characteristic of the synonymous token *plague*, which are united by the gradual seme 'degree of spread of disease / illness' (from the meaning of "epidemic" (characteristic of plague) to the meanings of "highest epidemic", "extremely strong epidemic" (pandemic)).

In the third stage of the study, the graph is modelled. In the Gephi graph visualization programme, synonyms, components of their meanings, as well as arcs, are displayed in shades of blue to visualize the number and quality of semantic connections between LSF units. We conclude that the more connections synonymous words are connected, the darker they are on the graph, and the more connected the edges with which they are connected.

Thus, the formalized method of analysis of the language data material of LSF provides a comprehensive study of its components, reveals the nature of relations between units and determines the specifics of the organization. With the help of a lexico-semantic graph it is possible to visually depict the relationships between units to denote any concept or phenomenon. On the other hand, through the disclosure of semantics and the relationship between sets, the whole structure of the field is revealed.

Prospects for further research are seen in the detailed study of the composition and organization of LSF pandemic microfields in the Ukrainian language and their graph-matrix modelling.

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