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EFFECTIVE FIGURATIVE MEANINGS INTERPRETATION FOR ONLINE TRANSLATION PACKAGES

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Abstract

The modern theory holds that linguistic software is not yet completely able to decode figurative meanings like metaphors and idioms. The suggested approach to the way the words and their meanings function in the lexicon can help to solve the language problem of artificial intelligence systems, which process information like human brains. We claim that figurative meanings of polysemous words are based on lexical invariants. Their revealing will help to decode contextual idiomatic figurative meanings, improve online translation packages and make a valuable contribution to on-line lexicography. The pressing problems presented in this article in connection with the proposed invariant theory aim at proving whether lexical invariants really make complicated semantics of metaphors more transparent. The article presents an invariant empirical analysis of a polysemous word “key”. We claim that there are numerous interconnected semantic networks of polysemous words in the lexicon. They function as multi-level configurations of meanings, which are cemented by dominant invariant meanings. Invariant meanings are eventually formed as a result of multiple use of the word metaphorical meanings, which allow native speakers to effectively navigate in the surrounding language environment. The invariant lexical components form clusters of integral and differential types that, when combined in different configurations, form a word context meaning.

Keywords: Lexical cluster, meaning, mental lexicon, metaphor, online translation packages, semantic network.

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1. Introduction

In recent years, systems based on artificial neural network simulation are rapidly developing. This technology is based on the principle of the biological neural networks organization and functioning. However, the fact that such systems are self-learning, does not bring humanity a step closer to creating strong artificial intelligence. The main task in the field of linguistics that computer networks still cannot completely carry out is understanding of lexical idiomatic figurative meanings.

Human speech and thought activities deal with processing and decoding information in the form of schemes, semantic networks, frames, categories, concepts, scripts, gestalt, sets of components, etc. However, the phenomenon of polysemy, so widely studied, but not fully disclosed poses a significant obstacle for contextual metaphorical and phraseological units decoding. For a human being understanding such figures of speech (metaphors, metonyms, idioms, allegories, abstractions, etc.) means performing a number of cognitive operations. The latter do not present difficulties for human being as these are innate abilities.

Biological systems have long served as an inspiration and a design challenge for the engineering of artificial intelligence and machine learning (Manicka & Levin, 2019; Simon, 1981; Wiener & Schadé, 1965), with a special focus on the brain. It is worth mentioning that contemporary knowledge in the field of brain functioning and IT technologies has reached the level at which it is possible to confirm or reject "a computer metaphor". According to Lilly (2004; 2006), a human body is just a biocomputer, possessing and operating the programs embedded in it, including, for example, self-programming, the development of conditioned and unconditioned reflexes. In this respect, one of the major problems of creating the mind analogous to consciousness is to avoid semantics as computer programs operate only with syntax. Computer systems are free from semantics, self-reflection and can only imitate human emotions, without empathy, ethics and other human-specific anthropological attributes.

2. Problem Statement

Despite a large number of studies in the area of semantic meanings, linguists have not come to a consensus, whether a person operates in his/her lexicon within the lists of unconnected meanings or they deal with co-related meanings within semantic structures of polysemous words. Some authors claim that the meanings are stored in a form of lists, similar to dictionary entries (Brocher et al., 2016; Foraker & Murphy, 2012; Frisson, 2009). Others support the functioning of one general meaning that underlies all polysemous entries (review in Pustejovsky, 2002). The existence of at least two conflicting theories determines the relevance of this work and the need to revert to the analysis of polysemous words semantic structures.

In this research we present the study of the internal organization of polysemous words semantics. Our long-range aims are confined to investigation the way our semantic space is organized and in what form figurative meanings (like metaphors) are stored and function in the mental lexicon. In this light, we can put forward a working hypothesis that can explain numerous interconnected semantic networks of polysemous words function as multi-level configurations of meanings. One reasonable idea to account for this is the functioning of dominant invariant meaning which presumably cements the whole word

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structure. It is important to verify the invariant theory in the light of the artificial intelligence doctrine, which allows us to bring the theory to a practical level and confirm the validity of the results obtained.

We hold that gradually, with the development of words' semantic structures the formation of lexical invariant takes place as a unity of the most frequent core semantic components of a general character. Lexical invariants are supposedly formed as a result of multiple contextual realizations of words meanings. Presumably, a word's lexical invariant functions as more or less stable semantic model or formula of a word in the stream of contextual meanings variation. It governs the processes of figurative meanings formation, regardless of whether they are concrete or abstract, formed as a result of radial, chain, or mixed word structure. This complex of core components covering the semantics of all figurative meanings provides a quick access to the metaphors. In this respect, a difficult task to be carried out is connected with a construction of semantic networks for solving the problems of semantic search and linking of various language resources.

3. Research Questions

The following major problem for intelligence systems arises in connection with metaphors semantics. One of the most important feature of metaphors is their semantic incompleteness and hypothetical nature. Metaphors provide a new vision of reality and literal language may seem too limited for that. In our research we consider metaphor imagery as an important cognitive mechanism of metaphor interpretation.

In the course of our study, some vital questions arise. Thus, if a metaphor is considered as a shift in the categorization how can we account for its semantics? We should provide semantic attributes, which would explain metaphor semantics. We consider lexical invariant as an abstract meaningful semantic core or a combination of the most essential basic semantic components that are stated logically and empirically during component analysis. The revision of current related hypotheses will help us to answer the following question: how can invariant cluster semantics be of any help for us?

The proposed study reflects the world trend in cognitive semantics and psycholinguistics, aimed at helping to solve the problem of semantic meanings ambiguity. We will try to give the convincing reasons for the semantic integrity within polysemous structures. We hope that the invariant theory would offer the original solution of the polysemy problem.

4. Purpose of the Study

One of the chief aims of our research is to test the following hypotheses:

- invariants are constructs that optimize the functioning of various figurative meanings in the structures of polysemous words;
- cluster structures are flexible, dynamic and open, capable of developing and restructuring of their components; they include extra-strong (integral) components and some other: differential, potential, emotional, etc.;

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- invariant cluster approach helps to determine vectors of new metaphors formation (the newly coined meanings possess invariant components);
- a word invariant cluster unites all semantically correlated meanings in one bundle, not allowing them to split into homonyms; thus, invariant clusters distinguish polysemy from homonymy.

This brings us to the need of a multi-vector approach of meanings studying, combining, on the one hand, cognitive, computational and bio-cognitive interpretation of meanings and, on the other hand, such dichotomies as language and computer, language and speech, language and physiology.

The proposed theory can also account for the models of language communication. We hold that when an individual releases (metaphorically speaking) a material speech-form according to the context in the process of communication, the listener activates in his consciousness that part of the lexical network which possibly corresponds to the given information. At the initial stage of this process, most probably semantic components of the most general character are activated. So what we call "a dictionary meaning" with all its semantic components is not relevant, because its "observing" is time consuming. During the process of a material word form decoding, the consciousness does not actually activate all semantic components that have ever been connected with the heard word (for example, the components that we can find in the dictionary for each particular word). Very often rather vague and general outline of the word semantics can be sufficient for understanding. We do not as well scan all possible and known meanings of the word employed in a communication process. The use of a dominant invariant cluster is not in contradiction to the principle of language economy, according to which a speaker or a listener does not have unlimited time to process the information: in most speech contexts comprehension of general meanings or outlines of word semantic is quite sufficient.

5. Research Methods

By using invariant componential analysis and other methods we also tried to prove the idea that speakers very often do not need a detailed information to understand and interpret this or that meaning. The article presents an invariant empirical analysis of a polysemous word "key". We claim that there are numerous interconnected semantic networks of polysemous words in the lexicon. They function as multi-level configurations of meanings, which are cemented by dominant lexical invariants. Our approach to the phenomena under consideration employs the definition of the most essential universal semantic components, which remain unchanged in the stream of meanings variation composing the semantic formula of a word or a phrase.

Invariant meanings are eventually formed as a result of multiple use of all metaphorical meanings clusters, which allow speakers to effectively navigate in the surrounding language environment (Solonchak & Pesina, 2015).

The main method proposed in this article is component analysis of dictionary definitions. We also employed a cognitive analysis of figurative meanings based on revealing the underlying images. Besides, our semantic analysis is carried out on the basis of introspection and the use of description and comparison as universal linguistic methods. These methods rely on the researcher's ability to plunge into

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reflection and insight. To do this, the researcher frees himself from any biases, rejects any hypotheses and focuses on the uniqueness of thoughts and perceptions.

6. Findings

By using invariant componential analysis and other methods we tried to prove the idea that speakers very often do not need a detailed information to understand and interpret this or that meaning. To illustrate the functioning of a lexical invariant cluster, we present the results of our analysis of a polysemous English word "key". The first nominative non-derivative meaning of this word is formulated on the basis of dictionary definitions using component analysis and the frequency principle: "*a piece of metal, specially shaped, used for opening or closing a lock*".

The first meaning motivates the metonyms and phraseological units of this word. Meantime, numerous metaphors (key of a valve / clock winding mechanism, key of a pass phrase, key to the success, the key to a riddle, keys to nein an arch, a free-throw in basketball: free throw lane; an arrangement of the salient characters of a group of plants or animals or of tax a designed to facilitate identification, characteristic style or tone, the predominant tone of a photograph with respect to its lightness or darkness) are motivated by semantic features highlighted during component analysis (Pesina et al., 2019).

The results of the invariant-component analysis showed that all the metaphorical meanings can be divided into five clusters according to the main invariant component underlying them (marked by different colours in Figure 01 below):

1. something preventing prom moving;
2. something initiating work;
3. something providing / preventing access to some information (providing / preventing access to some information);
4. something providing explanation / understanding (providing explanation / understanding);
5. something of primary importance.

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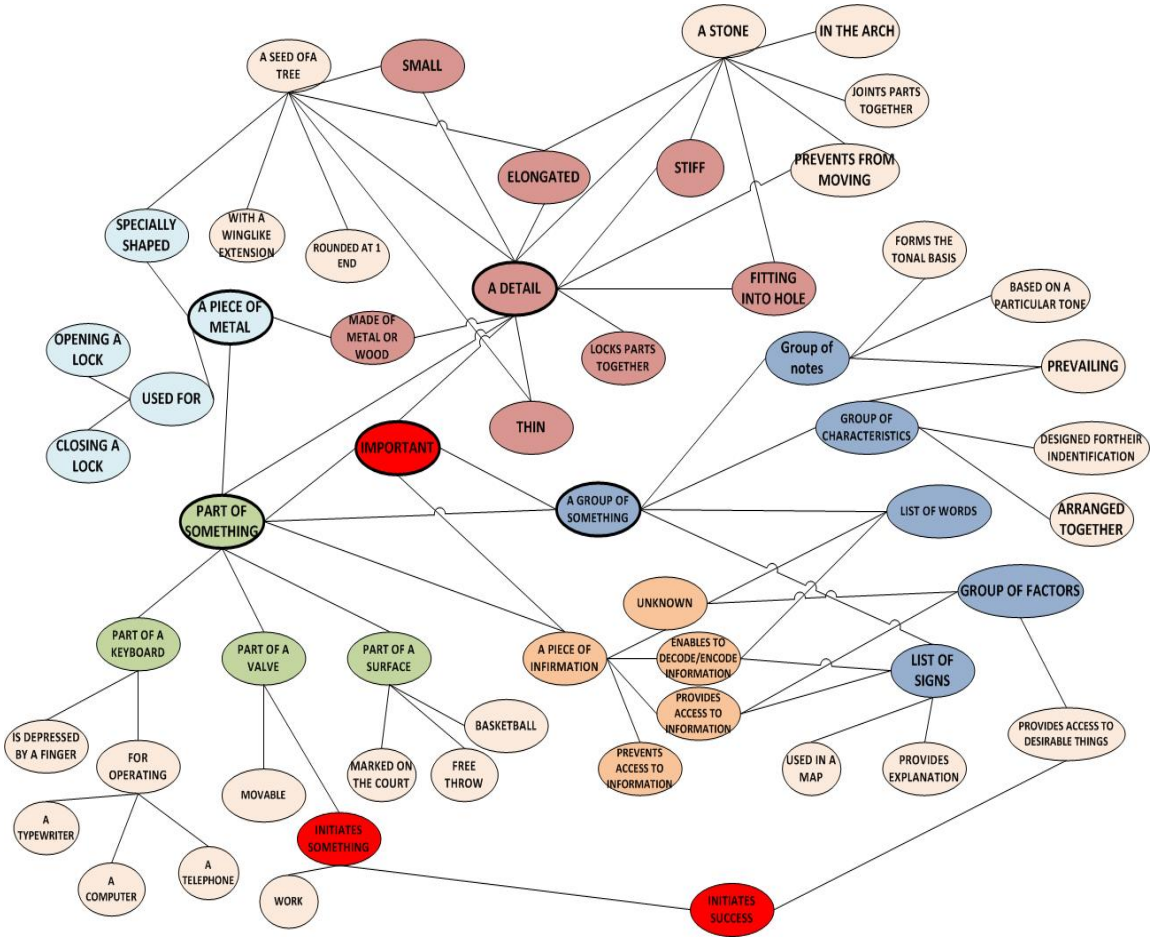

Figure 01. The results of the invariant-component analysis of a polusemous word "key"

Thus, it is possible to formulate a lexical invariant of a substantive "key", i.e. its meaningful core:

something like a key (**initiates something, providing/ preventing access to some information, providing explanation/understanding, initiating work, of primary importance/specific to something**) This abstract core is devoid of any subjective components. In the same time, it contains all necessary components to directly explain semantics of all metaphorical meanings of a polysemous word "key". The maximum abstraction from the details made it possible to single out its most essential components of a general character, which actually cover the semantics of all the meanings of the word under analysis.

The status of a component can be either integral (extra-strong) (for example, *initiates something, of primary importance*), serving a construct element for all meanings of the word, or differential. Integral invariant components have more links or vectors to other meanings, than to differential ones. We cannot state integral invariant components in the semantics of this word (linguists considered this word very difficult for component analysis (Palmer, 1982; Vinogradov, 1972). Still, all invariant components form the word's "carcass" and have the fastest access in the system.

The combination of cluster and component analyzes in our study allows us to work with a large number of related semantic features (combining first semantic attributes and then meanings in clusters). The obtained semantic core of this word serves as evidence of the fact that we are dealing with a one word structure (in many studies the word "key" is classed as homonymy).

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We can find the indirect confirmation of the invariant cluster theory in the studies of neurophysiologists (Baars & Gage, 2014; Luriya, 1973), who claimed that neuron network is analogous with the word net and eventually we need less information (in our case semantic attributes) to grasp the word meanings in the process of communication.

We are inclined to believe that the human mental lexicon is organized in the same way as neuron networks. We are convinced that at the first stages of the concept formation information can be excessive, but then it turns into minimal necessary nuclear components. In the course of our analysis, we took into account the images that arise during the analysis of metaphors. While scanning the visible or imaginable picture, the brain splits it into small fragments, processes the information, and then presents it as a holistic image. Any mental images, including tokens and concepts, must be considered from the point of view of "carefully developed knowledge networks" (Baars & Gage, 2014).

Basic, frequent semantic components have better connections with each other and it takes less time to awake them while thinking of a word. Very often one or two components of a general character are sufficient to understand a word meaning. That is why a word meaning is considered as uncertain, and vague with undefined open boundaries.

Polysemous words clusterization can occur on two correlated levels – lexical and semantic. The first lexical level reveals clusters of the meanings united on semantic principle (meanings of similar semantics are associated together), the second semantic one – the invariant cluster – functions at the level of abstractions, organizing semantics of all word meanings. The latter is formed of the most important basic core components covering semantics of all figurative meanings. Interestingly, Oxford English Dictionary attempted to group word meanings on the principle of a basic component.

The undertaken analysis has practical significance; it can be carried out for didactic purposes in teaching English as a second language, and for lexicographic practice. Lexical invariants can assist learners in memorizing the multiple meanings of polysemous words. The invariant cluster approach can be used in electronic dictionaries creation, as their developers obviously encounter difficulties with translating metaphors, idioms and other figurative meanings. One of the aim of our study is to create a dictionary of invariants, where lexical invariants could be presented at the beginning of each polysemous word entry. It is also worth mentioning that in teaching English as a second language and didactics (Baranova et al., 2019; Bylieva & Sastre, 2018; Kabanova, & Kogan, 2017; Razinkina et al., 2018) as well as in cognitive linguistics and philosophical descriptions (Serkova et al., 2017) polysemous words and their contextual nuances are often considered as obstacles to language acquisition. That is why words semantics requires the urgent attention and rigorous analysis.

7. Conclusion

The purpose of our research was to demonstrate and prove the idea that lexical invariants can help to decode contextual idiomatic figurative meanings and metaphors. For this purpose we presented the results of the invariant empirical analysis of a polysemous word "key". In the framework of this analysis the objective was also to state invariant essential semantics of metaphorical meanings. The purpose of the rest part of the analysis was to verify the hypothesis that invariant components, formed as a result of the word structure development, are inherent to language. Such formations frame and limit the word content,

freeing the mind from the need to scan the whole range of meanings in conformity with the principle of language economy (Pesina & Yusupova, 2015).

The analysis of more than 100 polysemous English words made it possible for us to come to the following conclusion: polysemy research remains relevant to this day, since understanding of meanings functioning can help to answer numerous vital questions. The crucial one is how the entire mental lexicon is organized. It could also be helpful in metaphoric meanings interpretation for the artificial intelligence research. The presented invariant-cluster approach to polysemous words investigation has the following advantage: our analysis of English and Russian nouns, as well as our linguistic experiments, reveal that the most frequent semantic components (*important, upper, lower, big, small, large* and the like) often become invariant ones; connections between them and other semantic components, denoting nouns are the strongest ones.

A multidimensional study of the semantic structures of polysemous words allows deeper understanding of how person's memory is structured and functions, how we understand each other using figurative contextual meanings. In the same time, a lexical network with many semantic entries and exits create a complex multi-levelled system of various connections that allow us to effectively navigate our the virtual world.

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