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EXPERIMENTAL STUDY OF POLYSEMOUS WORDS SEMANTICS IN THE LIGHT OF INVARIANT APPROACH

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Abstract

The main purpose of this research is to study the internal organization of the polysemous word semantics on the subject of how the semantic space is organized and in what form the meanings are stored in the mental lexicon. Despite the large number of studies in this area, linguists have not come to a decision whether we operate within the lists of unconnected meanings or whether the core meaning holds a polysemous word structure as a unit. The unsolved problem of polysemy determines the relevance of the research in this area. The paper presents the results of a psycholinguistic experiment in which the informants gave interpretations of polysemous Russian words not determined by the context. The results of the study proved that a native speaker does not need to store the detailed definitions for operating and storing the polysemous meanings. It shows that the order of storage of meanings in mental lexicon does not correspond to the order given in explanatory dictionaries. The frequency and a number of extra linguistic factors (interests, age, social status, etc.) influence this factor. Often a native speaker puts forward a meaning that is not frequent but relevant at a given moment of time. The meanings are fluid, unsteady, they are formed at the moment of speech and operate within the limits of main invariant semantic components.

1. Introduction

Psycholinguists consider the representation of meanings in the mental lexicon a complex cognitive issue. The mental lexicon as the cognitive system that constitutes the capacity for conscious and unconscious lexical activity reflects human interpretation of the surrounding world. The study of the basic principles of the human lexicon organization presupposes the disclosure of not only linguistic, but also extralinguistic culture dependent knowledge storage. Analysis of the representations of meanings in the individuals' minds predetermines the study of the basic principles and ways of the information organization in the mental and language domains.

A large number of works investigating polysemous words structures raise the question of contextual meanings ambiguity (a detailed review of experimental studies on polysemy in (Falcum & Vicente, 2015; Frisson, 2009). It is worth mentioning that the results obtained in the course of experiments often contradict each other. Some authors claim that the meanings are stored in a form of lists, similar to dictionary entries (Foraker & Murphy, 2012). 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.

2. Problem Statement

In order to answer the question concerning the maximum number of meanings a native Russian speaker can reproduce at a time without preparation a linguistic experiment was performed. We were also not certain whether the order of the represented meanings would, to some extent, follow the order of the corresponding word meanings presented in explanatory dictionaries of the Russian language. Finally, we were curious about the variety of interpretations of lexical meanings the informants are ready to provide.

We will then continue our investigation with the interpretation of the results of a linguistic experiment carried out in Russia. It will allow us to have a general overview of the form in which the meanings are presented in the mental lexicon and contribute to a possible verification of the theory of lexical clusters and semantic networks functioning in our "mental space".

3. Research Questions

It has been part of our aim to make a comprehensive survey of the way semantic space of a polysemous word is organized.

In this research we presented the study of the internal organization of polysemous words semantics on the subject of how the semantic space is organized and in what form the meanings are stored in the mental lexicon. Despite the large number of studies in this area, scientists have not come to a conclusion whether people operate with the lists of meanings or whether the core meanings represent polysemous words semantic structures. The paper presented the results of a psycholinguistic experiment in which people under testing without any preparation gave interpretations of polysemous Russian words. The results of the study proved that native speakers do not need to use detailed word definitions when operating polysemous words. It has been demonstrated that the order of polysemous words meanings in

the mental lexicon does not correspond to the order given in explanatory dictionaries (Solonchak & Pesina, 2015). The established priority of the meanings order was based on the frequency principle and a number of extra linguistic factors (interests, social factors, environment, etc.). Native speakers put forward meanings that were relevant to life at those given moments of time and were often not registered by contemporary Russian dictionaries. The results of the study confirmed the basic principles of the semantic theory – meanings are fluid, unsteady constructs, formed at the moment of speech and adapted to specific surroundings or conditions in which a person lives and operates.

4.   Purpose of the Study

Within the scope of this article our objective is to work out the form in which the meanings are stored in the mental lexicon. Since in the process of speech perception the listener foregrounds the most general, basic, frequent components of a word, which are connected by the strongest neural links, a word meaning can be justifiably seen as unfixed, uncertain, and vague, with undefined open boundaries. Component formation of a meaning most likely occurs in two directions: it can have an extended character with multiple identifying components (it might be the initial stage of a word formation), later compressing to minimally necessary core components. For greater simplicity and convenience, eventually flexible semantic clusters can be formed to get better access to word meanings. It is probably a typical scenario for polysemous words formation and storage.

As the structure of any frequent polysemous word is a dynamic correlation of meanings integrated into a semantic network, the most frequent meaning represents the whole word in the mental lexicon. This meaning has the shortest correlating pathways to the corresponding sound or graphic form. 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, formed as a result of multiple contextual realizations of words meanings. A lexical invariant of a word functions as a more or less stable semantic model or formula of the word in the stream of contextual meanings variations. It also governs the processes of figurative meanings formation (Pesina et al., 2019). This complex of core components covering the semantics of all figurative meanings provides quick access to metaphors.

5.   Research Methods

The paper presents the results of a psycholinguistic experiment in which the informants enumerated the meanings of Russian polysemous words and gave their interpretations. The following proposed methods allow us to interpret the obtained results in order to solve the stated above problems. In the course of interpretation of the experiment results, such universal linguistic methods as comparison, description, statistical calculation, as well as definition and component analysis have been used.

Each informant out of 95 participants aged from 18 to 23 was offered a list of six polysemous Russian words belonging to the cognitive category "Parts of plants": *koren' (root), vetka (branch), cvetok (flower), list (leaf), zerno (grain), stvol (trunk)* (Pesina, Zimareva et al., 2019). The participants were supposed to enumerate all possible known meanings of these polysemous words in some order, as well as to give interpretations of the listed meanings in any form: semantic components, word combinations and

even sentences. The lead time was limited to 20 minutes. After processing the results, five out of 95 questionnaires were removed from the experiment, as participants completed less than 50% of the proposed test volume. Based on the obtained information and data processing, we have come to interesting conclusions.

6. Findings

None of the informants succeeded in making up a complete list of meanings, which would correspond in any way to the meanings reflected in any Russian language dictionary. The vast majority of the informants limited themselves to reproducing one or two meanings out of four-six existing meanings. The list of reproduced meanings included the most frequent meanings that were relevant to them at that period of time. Thus, the structure of the word *list (leaf)* for 55% of the informants started with the meaning *list bumagi (a sheet of paper)* which exists in Russian but is metaphorical. The primary and most frequent meaning according to the dictionaries is list rastenija *(a leaf of a plant).* Similarly, the meaning *vetka metro (a metro brunch)* was the dominant meaning instead of *vetka dereva (a tree branch)* which is registered as the primary and most frequent meaning of the word *vetka (branch)*. These meanings appear due to the cultural and social linguistic environment of the informants. The latter explains the choice of the meaning stvol oruzhija *(*literally *a trunk of a gun)* (in Russian *a barrel (of a gun)* and *a trunk (of a plant)* are meanings of the same word *stvol*) as the opening meaning of the polysemous word *stvol* (*trunk*). In the dictionaries of the Russian language, the first meaning of the word *trunk* is *a trunk of a plant,* the same as in English. As carrying weapons is forbidden in Russia, the appearing of the first meaning as *a barrel of a gun* is due to the abundance of gangster films. In the same way the collocation *vetka metro (a metro brunch)* occupied the first position because of extra linguistic factors, while the meaning *a tree branch* was moved to the second place.

1. Among the answers there were some occasional meanings, which were not found in Russian dictionaries or corpuses: zerno – mikrokristally v foto jemul'sii pri obrabotke foto (*grain – microcrystals observed in photo emulsions during photo processing*), zerno – melkie detali na ukrashenijah (*grain – small details on jewelry*), stvol – stvolovye kletki (*trunk – stem cells*). Interestingly, 90% of these occasionalisms are of narrow usage, so they will hardly become neologisms.

2. When interpreting the first meaning, the informants brought in lots of semantic components, which reflected their subjective points of view on the described object. For instance, koren' – syroj, grjaznyj (*a root is moist, dirty*), cvetok – krasivyj, raspustivshijsja (*a flower is beautiful, blossoming*), zerno – budushhij pobeg, kotoryj mozhet vyrasti v nechto bol'shee (*a seed was characterized as a future shoot that could grow into something bigger*), list – priznak togo, chto derevo zhivo (*a leaf is a sign that the tree is alive*).

3. It appeared that the informants highlighted the most significant and relevant parts of the concepts of the corresponding objects (of course, according to their reflections). So, the mental lexicon seems to be much more diverse and unpredictable than the content of explanatory dictionaries. The culturally and socially determined personal subjective perception of the

environment appears to constantly correct what we call the linguistic picture of the world. The way they understand the meanings of a word reveals their interaction with the environment. We can observe that the denotation meanings were actively ignored by our informants.

4. The more abstract the meaning, the fewer semantic components were provided by the informants as its explanation or interpretation. In 30% cases one idiom was used as an interpretation of another idiom or phrase so that the whole meaning remained unclear. Very often the interpretations were merely associative, for example, koren' – jeto koren' slova/koren' problemy/ pervoistochnik, nachalo problemy (*a root is the root of the word /the root of the problem / the source, the beginning of the problem*), zerno – zerno istiny/to, s chego nachinaetsja /osnovnaja mysl' /krupica (*a grain – the grain of truth / the beginning, the source / the main idea / a kernel*), cvetok – cvetok zhizni /deti (*a flower – a flower of life / children*), list – bumaga/nachat' zhizn' s chistogo lista (*a sheet – a piece of paper / to start life from scratch, to turn over a leaf*); stvol – oruzhie /chast' kolonny *(a barrel – weapon / part of a column).*

These associations emerged in the memory of the informants when they were trying to recollect the contexts in which the phrases were used and the latter apparently highlighted the corresponding parts of their lexical network. This relates in some way to the neuron synoptic firing. Neuropsychological studies also confirm that our perception is based on component clusters rather than ready-made meanings and word combinations. They hold that the visual cortex of the brain has a huge number of highly differentiated neurons, each of them only reacting to one component of a perceived object (Baars & Gage, 2014, p. 340, pp. 587-592). Word meanings and their components are connected together like a chain that corresponds to neurons firing.

Interestingly, neurophysiologists confirm the theory of semantic nets, stating that behind each word there are many links, not only semantic ones. For instance, Luriya (1979) claims that initially, a human brain understands objects as an assembly of components, in which the brain divides received images or information, but with growth, understanding of an object acquires an "iconified character" (pp. 31-39).

The meanings, as well as their semantic attributes, form multileveled semantic networks. In the semantic networks representation of frequent vocabulary is characterized as foreground or priority. They form a quickly attainable surface layer, comparable to what the outstanding Russian linguists Potebnja (1959) and Katsnel'son (1986) called «the closest meaning» of a word or its «formal meaning» (correspondingly).

Meanwhile, construction of numerous semantic and lexical pathways as well as the thinking process itself and its awareness (self-reflection) are energy consuming. Therefore, the informants, no matter how deeply they were involved in the thinking process, are always ready to stop if they are aware of the fact that the meaning is recognizable. It is not clear yet how the selection of meanings occurs and interpretation are actually construed (whether semantic spaces are superimposed or whether sampling occurs more or less automatically). Still, it seems that the majority of informants are not inclined to carry out deep semantic «excavations». These issues are the subject for the future research, and yet we are ready to make some interesting observations:

- we did not observe any attempts to enumerate the meanings of a word in accordance with some order accepted by the dictionaries (first, the primary meaning, then secondary ones, finishing with far-fetched comparisons like genuine metaphors). Probably, the order and retention of meanings in one's memory are formed individually, depending on the experience and interests of a person (for example, the meaning stvol ruzh'ja *(a barrel of a weapon/gun)* was in 100% cases the first though it is a metaphor). In the polysemous word *list (leaf)* the metaphor *list bumagi (a sheet of paper)* was also the first to be mentioned (in Russian *a plant leaf* is associated with *a sheet of paper*).

- 40% of informants made very unusual interpretations that in our opinion did not reveal the content of the meanings. Thus, if we read the semantic interpretations apart from their meanings, we will not understand what they are about, i.e. we will not recognize the meanings. Some interpretations were fragmentary, incomplete, general, obscure or incorrect. This indicates a low level of individual awareness of what they were writing and what sort of information they were providing. To the same extent, this indicates the subjective character of individual semantic network development.

- The following chart reflects the fact that only the first meanings of 6 polysemous words were represented. Two or three more figurative meanings were reproduced out of 6-7 meanings of each chosen for the experiment polysemous words (Figure 01).
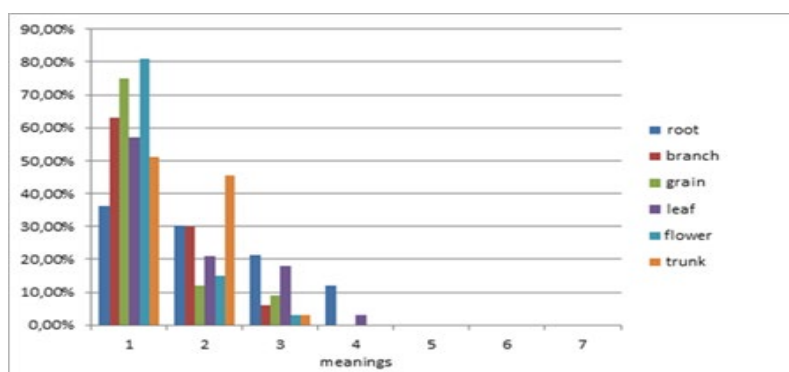

Figure 01.   Percentage of the number of meanings given by informants to the total number of meanings recorded by Russian explanatory dictionaries

- there are abstract interpretations that illustrate the use of semantic components of a general character such as *koren'* – osnova chego-libo (*root – the basis of something*), stvol – chto-to tverdoe i prochnoe (*trunk – something hard and solid*), zerno somnenija – samorassuzhdenie, sposobnoe okunut' v somnenija (*grain of doubt – reasoning, something that can make a person plunge into doubt*), vetka – raznoobraznye soedinenija (*branch – various connections*). Such examples illustrate attempts to formulate kind of a lexical core of the word structure that covers the semantics of all its metaphors. In our study, we call them **lexical invariants**. Their presentation reveals deep semantic layers of the lexicon which is formed as a result of numerous usages of these meanings.

The represented meanings prove the fact that our lexicon is a dynamic developing and subjective storage of data, where personal interpretation of the entering information often prevails over objective "denotative approach" to information processing. The given word definitions pointed to the fact that information processing occurred with a great deal of individual assessment. There was a lot of detailed information that was confused and obscure. That is why some semantic structures were formed in a chaotic manner.

7. Conclusion

The problem of polysemous word commonalities remains unsolved until now, since all researchers have not reached a united conclusion of the way language speakers operate all the meanings of a polysemous word, the way they are stored in the mental lexicon, and the way language speakers decode figurative meanings while creating new ones (Pesina & Yusupova, 2015). 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.

There are two main hypotheses of the mental lexicon structure. According to the first theory, meanings are stored as a list of ready-made lexical-semantic variants, out of which one is picked during the speech process. Another point of view proposes a common semantic part that unites and structures polysemous words meanings.

The problem of a polysemous word semantic unity can be solved by postulating an uncontextual language gestalt – generalized experience of using contextual realizations of a word. This content core has the following features:

- semantic components narrowing to minimally necessary ones (hidden, potential, associative for the primary meaning) and fixed ones, central for metaphorical meanings;
- maximum recognizability;
- generally objective character, i.e. it is formed in the lexicon of an average language speaker with time, and changes as time passes.
- The results of the study confirmed the basic principles of the semantic theory – meanings are a fluid, unsteady constructs, formed at the moment of speech and adapted to specific surroundings or conditions in which a person lives and operates.

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