

REVIEW

By prof. Maxim Ivanov Stamenov, DSc, Institute for Bulgarian Language "Prof. Lyubomir Andreychin", BAS

of a dissertation for obtaining a PhD degree

Author of dissertation: **Hristina Nikolova Kukova**, doctoral student at the Section of Computational Linguistics, Institute for Bulgarian Language "Prof. L. Andreychin", Bulgarian Academy of Sciences

Topic of dissertation: **Formal description of perceptual and mental predicates in Bulgarian (removal of semantic ambiguity)**

Scientific adviser: prof. Radka Vlahova, PhD from SU "Sv. Kliment Ohridski".

The total volume of the dissertation is 379 pages, which includes 280 pages of main text and 98 pages of appendices. It contains an Introduction, four chapters, Conclusions, consequences and guidelines for future work, contributions and 2 appendices. The work includes 38 tabular summaries and 4 figures.

1. Relevance of the problem developed in the dissertation in theoretic and-applied terms

The problem to which the proposed dissertation is devoted is very relevant in the context of the latest directions of information technology development in order to expand their capabilities for automatic processing of information in natural language. The work is a thorough study of the predicates of perception and mental predicates where these perceptual verbs have developed derivative meanings in this direction. A model for formal representation of predicates in order to remove their semantic ambiguity is proposed. The author's ambition was to include the maximum number of verbs in the meaning of the semantic components "perception", "perceiving" and "perceived". For this reason, in addition to the traditionally studied active and passive predicates for perception, stimulus-oriented, interoceptive and proprioceptive verbs are also included here. The logic of scientific research predetermines the development of its content in 6 chapters.

The introductory Chapter 1 (pp. 5-27) offers definitions of the predicates for perception and the basic terminological apparatus used in the work. The object, goals and tasks of the research are postulated. The central role of semantics is justified, as well as the choice of resources for its analysis. A model for presenting the Bulgarian predicates for perception through a formal description is proposed, which is in line with the objectives of the automatic removal of semantic ambiguity.

Chapter 2 "Meaning and grammatical removal of semantic ambiguity" (pp. 28-58) deals with the problem of the meaning of perceptual and derived mental predicates. Basic theoretical statements in the field of lexical meaning such as monosemy, polysemy, homonymy and metaphorical uses of verbs for perception in traditional and formal-semantic research are discussed. Paradigmatic, syntagmatic and conceptual criteria for defining individual meanings are indicated and different models for the presentation of the lexicon are discussed. Here, too, the concept of automatic removal of semantic ambiguity is defined and various methods for its implementation are offered. The main problems that the automatic removal of such ambiguity faces in its implementation are discussed. In this regard, an overview of the types of approaches

used in automatic ambiguity capture. Innovative here is the comparison of traditional and formal-semantic definitions of ambiguity, as well as the comparison and grouping of different approaches to removing such ambiguity.

Chapter 3 “Semantic-grammatical classifications of predicates” (pp. 59-81) provides an analytical overview of fundamental semantic and aspectual-semantic classifications of predicates. The semantic primitives attributed in Wordnet, which were used in the predicate analysis, are listed. Particularly perceptual typologies are presented, which the author relies on in the typology of Bulgarian predicates of perception. The division of A. Viberg into active, passive and copulative predicates for perception is discussed in detail, as well as the later division of the last subclass into sensory copulas, verbs of receptivity, sensory verbs. Author’s contribution here is the description along the lines of the main features that affect the verbs of perception – these are the orientation of the verb to the Subject or Stimulus, agency / non-agency, causality / non-causality.

Chapter 4 “Semantic characteristics of verbs for perception” (pp. 83-175), which is the main one in the work, aims to present an analysis of the typological features of verbs for perception. A description of the prototype meanings of the perceptual predicates, as well as of the characteristic derivation models of the class of the considered predicates is offered. Manifestations of ambiguity in the class of perception verbs have been studied. An analysis of the connections of perceptual predicates with other semantic classes has been performed. Based on modern general and thematic classifications of verbs, a typology of Bulgarian perceptual predicates is proposed, taking into account their orientation - to the Subject / Experiencer and to the Object / Stimulus, volitional control of the external argument over the situation -- active-passive perception (agency / non-agency), real-potential perception (causality, inchoativity, negation). Of interest is the discussion of the oppositions in active-passive perception and subject- and object-oriented verbs for perception. On this basis, 210 of the considered 342 synonymous sets are grouped into 3 main types according to the way of projection of the sentence subject (subject-oriented (agency and non-agency) and stimulus-oriented perception) and 18 main types – according to different sensory modality (for each of the senses and for general perception). The remaining 132 synsets are grouped into another 12 types on the basis of these features, incorporating all three components of potential perception – causality, inchoativity and negation. The non-prototypical meanings of the main verbs from each group are also formulated, illustrated with examples from BNC. Non-prototype meanings are classified according to the types of perception verbs and the different semantics they encode. It is important to note as a result of the study that the broadest freedom of semantic derivation is demonstrated by verbs in the field of visual perception, which realize a significant number of non-prototype meanings, mostly with cognitive semantics. The review shows that the relevance of the proposed research is found mostly in this and the next chapter of the dissertation.

In Chapter 5 “Verbal meanings and arguments” (pp. 176-258) verbs are analyzed in terms of their syntactic functionality in terms of the types of meanings established in Chapter 4. First of all, attention is paid to the prototype representatives of perceptual predicates and their syntactic realization is illustrated in their individual meanings. For this purpose, it is based on the frame theory of Charles Fillmore, and each of the meanings is presented with reference to a specific frame. In this perspective, the frame elements of predicates, their semantic constraints, the types of constituents and their syntactic function in the sentence are defined. The identified frames are illustrated with language material from the BNC. With the collected empirical material the dissertation successfully demonstrates that the lexical-semantic information is reflected through the syntactic realization of the arguments and is coded in their semantic restrictions. The important finding is that in the case of perceptual predicates the restrictions imposed on the perceiver are wider – he must be an animate being. In the case of the mental, in return, the restriction is imposed that the Experiencer must possess reason

(potential for mental activity). With regard to Stimulus (as a semantic role), physical concreteness is necessary in perceptual predicates and in exchange for abstract essence in mental ones. In view of the findings made after the processing of the empirical material, the author's main contribution in this chapter consists in developing a typology of predicates related to appropriate formal description of structural characteristics and semantic constraints of the main arguments realized in individual meanings that would help the automatic removal of ambiguity. The latter is essential for computer modeling of the widely varied semantic diversity of language-specific structures.

The last Chapter 6 "Conclusion and Conclusions" (pp. 259-266) reviews the content of the dissertation and the main conclusions reached as a result of the research. Possible guidelines for future work are indicated, as well as the main contributions of the dissertation.

2. Orientation of the applicant in the state of the problem and the scientific literature dedicated to it

The author displays a good knowledge of the literature on the topic of the work. The bibliography for the dissertation contains a total of 147 publications of Bulgarian and foreign scientists, with which the dissertation student has worked in the implementation of activities related to research and writing her work.

3. Nature of the chosen methodology

The dissertation presents the nature of the chosen methodology in view of the tasks and goals of the work formulated in the introductory Chapter 1. The method of work includes several steps, developed sequentially in the chapters of the work. These include excerpting language material from Wordnet, expanding and enriching the empirical material with the help of RBE (1977-), forming predicate types based on the intersection of synonymous sets from the studied class with synonymous sets from other classes, syntactic representation of individual meanings of verbs based on their syntactic frames from Framenet and BNC and semantic parsing of their frame elements. Based on the identified methods of work, a methodical plan of research analysis has been developed. The method of work corresponds to the set goals and objectives. As can be seen from the description of the methodology, Wordnet, Framenet and BNC were used as the main resources for the systematic extraction of empirical material.

4. Brief analytical description of the scientific and / or applied contributions of the dissertation

We confirm the availability of the following contributions to the work. They are oriented in two main directions – theoretical and with potential for application.

The predicates of perceptual modalities are presented in the dissertation in the form of an independent semantic class. A generalized semantic-syntactic study of perceptual predicates has been performed with a view to their formal description for the purposes of automatic removal of semantic ambiguity. The changes in their way of use due to the expansion of the meaning of the separate lexical units are analyzed. The scope of the study includes predicates for potential perception (vision, sound) and neutral modality of perception (feel), for interoception (pain, tightness) which have not been considered and interpreted by other authors in the descriptions of verbs for perception in the Bulgarian language.

A model for analysis and description of verbs has been developed, with the help of which the observed interactions between the semantic structure and the syntactic realization of

the verb meaning are studied and presented. The methodology developed in this way can be used to describe other groups and subgroups of predicates.

Bulgarian verbs for perception are presented and distributed according to the way of coding the subject of perception, as well as according to their ability to encode various additional aspects (inchoativity, causality, negation) of verb-specific meaning.

A classification of Bulgarian verbs for perception is proposed, which is expanded and enriched compared to existing classifications based on the distinction between their prototype and non-prototype meanings. The former include meanings for sensory perception and their semantic derivation within the same semantic class. Non-prototypical meanings extend beyond the semantic field of perception. They are classified according to the sensory modality of the primary meaning and the semantic class of the derivative.

Highlighting the individual meanings of primary perceptual predicates, arguments and their syntactic realization in different meanings (including those that develop cognitive semantics) leads to greater clarity in their description and application in various resources for natural language processing. The expectations are, on the one hand, the richly branched relational structure of Wordnet and, on the other hand, the combinatorial potential of the lexical units in Framenet to give a good linguistic result. However, the task, as the work itself shows, is not trivial, as there is limited overlap of lexical items and the specifics of their coding in both resources affect both the results and their further usability (cf. p. 208-209)

The interdependence between the lexical diversity of the Bulgarian verbs, the types of arguments and complements they realize, their semantic limitations and the types of subordinate relations is traced in a systematic way.

The results of the research can find practical application in the development of programs for automatic removal of semantic ambiguity and automatic translation, as well as in translation practice, in the acquisition of Bulgarian as a native language, teaching Bulgarian to foreigners and comparative analysis of verbs of perception in different languages and cultures.

5. Evaluation of the publications of the applicant on the dissertation subject: number, nature of the articles in which they are printed, citations

The dissertation reports a total of eight articles and reports as publications on the topic of the dissertation. Some of them were written independently, and others – in co-authorship. Ms. Kukova has independently published three articles in magazines and thematic collections, as well as one participation with a paper at a conference, that was later published in her materials. She has co-authored two articles and has participated in two conferences with the publication of their materials. Three of the publications (two individual and one collective) are in the journal *Bulgarian Language*. There is no evidence provided that the articles related to the thesis have been cited by other authors. The described publications exceed the minimum requirements for obtaining the scientific degree “Doctor of Philology”.

6. Critical remarks

Extending the object of study from proper verbs of perception to verbs of mental activity has its price. In this situation, it turns out to be necessary to consider many verbs among those described, which include perceptual modality as a component, but their meaning is not limited to this. For example, *zamaskirvam* is defined as “disguising the identity of someone or something by changing the appearance (including disguise in atypical clothing) or marks so that it is not recognized if presented to another”. (p. 307). As can be seen from the proposed definition, it is a complex meaning, which includes a behavioral component in the form of actions to cover, so that when seen it is not adequately recognized (recognition is a cognitive

rather than perceptual action). The behavioral basis in the meaning of this verb is evident in its other basic meaning – that of “covering objects” (ibid.). Examples in this regard can be multiplied, as far as processes and actions of perception can be implied in a large number of verbs for a variety of mental activity and related behavior. This type of “expansion” of meaning should be distinguished from the mechanism of expanding meaning through metaphorical transfer, standardly described in lexical semantics, as is the case with *vizhdam* in the sense of “something becomes clear to me; I comprehend, I understand, I look” (RBE 1977-). For an appropriate distinction and description, it seems, it would be best for the researcher to turn to the system of coding the lexical meaning of Yuri Apresyan (2009), as it is explained by him and his collaborators in a detailed and systematic way.

The introduced distinction in view of the possibilities for expanding the meaning is related to the mechanisms and directions of generating ambiguity insofar as they are verified according to the methodology adopted by the dissertation in comparison with the data we find in RBE. For example, in RBE (1977-) 31 different meanings are distinguished for the verb *gledam*, and 21 different meanings for the verb *vizhdam*. It can be seen from Appendix 2 of the dissertation that not all of them could be certified with the help of the methodology adopted in the dissertation. In the verb *gledam* 19 out of 31 meanings recognized in RBE are not certified; in return, 2 are found here that are not in the dictionary. For the verb *vizhdam* the proportion is more favorable – out of 21 in the dictionary in the dissertation 9 are not recognized; in return in RBE there are no 4 described in it. The comparison in depth of the similarities and differences in the distribution of these meanings in *gledam-vizhdam* would be very appropriate and would show the essence of the distinction between active and passive verbs of perception (according to the classification in the dissertation). A similar procedure could be repeated for the second most semantically loaded pair of perceptual verbs *slusham-chuvam*.

In this regard, as a recommendation and not as a critical note, we would point out that there are opportunities to continue the work done in the dissertation by exploring strategies to develop ambiguities in different perceptual modalities in the direction of perception to cognitive activities, but also to emotive-affective processes.

7. Does the abstract correctly reflect dissertation’s content

The abstract is detailed and correctly reflects the main points and scientific contributions of the dissertation. It corresponds to the content of the work under evaluation.

8. Conclusion

Having in mind the above presented review, I propose to the Scientific Jury to award the applicant **Hristina Nikolova Kukova** the scientific and educational degree “Doctor” in professional field 2.1 Philology, scientific specialty General and Comparative Linguistics (Computational Linguistics) for her dissertation “**Formal description of perceptual and mental predicates in Bulgarian (removal of semantic ambiguity)**”.

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Signed:

(Signature)