

REVIEW

by

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for the competition for the academic position of “Professor” in the professional field

4.6 "Informatics and Computer Science", announced in State Gazette No. 65 of

12.08.2022 for the needs of New Bulgarian University,

with the sole candidate

assoc. prof. Velina Todorova Slavova, Ph. D.

1. Assoc. prof. Velina Slavova Ph. D. was born on 22.12. 1959 in Sofia. In 1982 she graduated in mechanical engineering and in 1984 - in applied mathematics and informatics at the Higher School for Mechanical and Electrical Engineering, Sofia (now - Technical University, Sofia). In 1989 she became a "Candidate of Technical Sciences" (now - "Doctor"). In 1997 she followed the Master's program in Cognitive Science at the Central-Eastern European Center for Cognitive Science at New Bulgarian University. Between 1989 and 1994 she worked at the Higher School for Mechanical and Electrical Engineering, Sofia, and since 1994 she works at New Bulgarian University. Since 1996 she has been a senior assistant professor and since 2003 an associate professor. Her procedure went very successfully through the Specialized Board of Electronic and Computer Engineering at the Higher Attestation Commission, of which I was a member then and I was a reviewer. In accordance with the Act of Development of the Academic Staff in the Republic of Bulgaria, her associate professorship is in professional field 4.6 "Informatics and Computer Science".

Assoc. prof. Velina Slavova has over 35 years of teaching experience not only in Bulgarian universities (the Higher School for Mechanical and Electrical Engineering, New

Bulgarian University, the Francophone Institute of Administration and Management, Sofia) but also abroad - in France (1999-2017), Belgium (2001-2011) and Egypt (2005-2011) and elsewhere.

2. According to the "Self-assessment report" of Assoc. prof. Velina Slavova, since 2003, she has authored a total of 83 articles and reports, one monograph, and 4 textbooks and educational aids, of which two, she is the sole author.

For participation in the competition Assoc. Prof. Velina Slavova has submitted her monograph and 8 scientific papers, refereed and indexed in world databases. All of them have been published after she became habilitated, i.e. not used in previous procedures. They are directly related to the professional field of the competition - 4.6 Informatics and Computer Science.

3. The contributions in the works of Assoc. prof. Velina Slavova can be grouped as follows:

- Modeling the cognitive process of language comprehension with Generalized nets;
- Modeling the basic syntactic structure of a sentence with a Fibonacci tree;
- Modeling the cognitive complexity of concepts and statistical verification of the model by examining corpora of children's speech;
- Revealing a statistically significant relationship between the emotional tone of a text and its phonetic composition.

In essence, the results are scientific and applied.

4. For participation in the competition Assoc. prof. Velina Slavova has submitted her book "Language, Concept Formation and Child Language Acquisition", published in 2022. It contains 4 chapters, and 5 annexes and is 158 pages long. I was one of the reviewers because, in a significant part, it is devoted to the application of the Generalized nets I have established. Below I will quote part of my book review, inserting supplements and suggestions.

The monograph deals with language as a system of information exchange. The used approach applies modeling and statistical testing of hypotheses linking propositions from the scientific fields of language, cognitive science, mathematics, and computer science.

The first part presents a model of understanding language messages, formally represented by a Generalized net processing parallel information flows. The analysis of the flows in the net shows that the assembly of a sentence image takes place in the presence of semantic "merging" concepts. This leads to an exploration of the sentence at the syntactic

level based on the Merge operation defined in the syntax. Analyzing Chomsky's model in terms of the finiteness of recursion leads to the obtaining of a covering Fibonacci tree connecting the elements of the basic syntactic structure. This leads to the assumption that the Fibonacci tree reflects principles of processing information units at the level of thought. Experiments based on ambiguities in Bulgarian grammar are performed, the results of which support this hypothesis. I will note that the model developed by the author is interesting, and correct and is the first Generalized net model in the field of linguistics. In my opinion, in the future, this model could be extended in the direction of adding elements of fuzzy and intuitionistic fuzzy logic, since, in practice, the described processes develop under conditions of indeterminacy.

The second part proposes a cognitive model of language faculty. The analysis of sources from cognitive science, brain science, linguistics, language acquisition, etc. leads to the assumption that information units are formed and categorized from the perspective of the biological system itself, in the first person. A "self-centered" cognitive model is proposed, representing the emergence of concepts as a process based on information sources internal to the system. The model is supported by an analysis of sentences from a corpus of child speech, showing how incremental basic syntactic constructions gradually emerge following the Fibonacci tree derived in the previous part, in which the subject of the sentence is the speaking child. It would be interesting, in the future, to create an Intuitionistic fuzzy cognitive map in the sense of E. I. Papageorgiou.

In the third part, an empirical approach is applied to investigate the process of concept formation based on a statistical analysis of children's speech at the initial stage of speech production. The sources of the large corpus of data compiled from free dialogues, in English and French, of children aged 9 months to 5 years are presented. Statistical analysis shows gender differences in the use of noun categories inferred by applying the cognitive model proposed in the previous part. Next, the general principles valid in the acquisition of the two languages are pursued. When children's words are classified according to existing part-of-speech systems, the acquisition process of English and French shows almost no similarity. The applied factor analysis shows that the first principal component of the spaces of the two languages develops in an almost identical way. Further, an explanation for this similarity is searched for in terms of the universality of the process of concept formation and their "computational" complexity. Classes of concepts are proposed based on major theories in

psychology. In my opinion, it will be interesting in the future to process the accumulated data also through the means of intercriteria analysis, created and developed in the last 7-8 years.

The fourth part proposes an information model of the process of concept formation. An assumption is made that the information units are obtained as the result of comparing flows from two sources, those coming from the biological system and those coming from the environment. Represented in this way, the process of creating information units satisfies the conditions of a theorem proved by Horibe concerning Fibonacci trees and their optimality. This modeling step leads to a representation of the process of creating information units by a Fibonacci tree. Applied in the context of the modeled process, this tree then describes getting the maximum amount of classified information at the maximum input entropy, with the minimum cost of biological and energy resources. The proposed concept classes are mapped to the levels of this tree following their abstractness. The resulting Fibonacci tree representation allows estimating the complexity of the classes of concepts in a way analogous to computational complexity. The proposed "cognitive" complexity of each class expresses the effort of forming an information unit as the number of operations of linking signals arising from the environment with those arising from the biological system.

Given that the resulting models, reflecting both the level of syntactic structure and the level of concept formation, are described by the same structure, a Fibonacci tree, a suggestion is made that the creation of basic information units such as concepts and the formation of larger information units such as sentences obey similar principles that reflect resource optimization.

In the Bulgarian scientific literature published so far, there are no books specifically of this kind. When I had to write a review of the monograph, I read it with great interest and discovered several things unknown to me. I rate it very highly. This book and the article "Parallel language and semantic treatment in AGN" constitute the first of the research directions of the candidate that I have mentioned.

The other presented publications of Assoc. prof. Velina Slavova are related to:

- Modeling the cognitive complexity of concepts and statistical verification of the model by studying children's speech in two languages (№ 2, 3, and 4);
- Revealing a statistically significant relationship between the emotional tone of a text and its phonetic composition (nos. 5, 6, 7, and 8).

Seven of the publications of Assoc. prof. Velina Slavova are in specialized journals with SJR, 3 of them are in Bulgarian journals, and one of them is a paper presented at an IEEE symposium. Therefore, I have a serious remark about the publication activity of the candidate: she has interesting results and in the future, she should develop them further and publish them in serious international journals where I have no doubt, they will be published.

Assoc. prof. Velina Slavova has provided a list of 15 citations that meet the minimum requirements of the "Regulation for the Development of Academic Staff of the NBU", but checking Google.Scholar shows that only her article "Towards emotion recognition in texts-a sound-symbolic experiment" has at least 7 more citations not mentioned by the candidate. Also, in the article:

Alexieva. J., E. Choy, E. Koycheva. Review and bibliography on Generalized nets theory and applications. A SURVEY OF GENERALIZED NETS (E. Choy and A. Shannon, Eds.), RAFFLES KVB MONOGRAPH NO.10 (Australia),

the following 3 articles of hers are cited, absent from her list of citations:

Slavova V., A Generalized net for natural language comprehension. Advanced Studies on Contemporary Mathematics, Vol. 8, 2004, No. 2, 131 - 153.

Slavova, V., T. Kujumdjiev, Parallel processing within a cognitive model of natural language comprehension. Int. Conf. Cognitive Modeling in Linguistics, varna, sept. 1-7, 2003, 433-439.

Slavova, V., A. Soschen, Parallel language and semantic treatment in AGN. Cybernetics and Information Technologies, Vol. 5, 2005, No. 2, 84-95.

And there are others that I found that are not listed.

5. The "Professional CV" of Assoc. prof. Velina Slavova shows that she has lectured on a wide range of subjects: algorithms and data structures, database design, statistics, numerical methods, and natural language processing. Under her supervision, 10 diploma works have been successfully defended in the last 5 years.

6. Assoc. prof. Velina Slavova has been the head of international projects, the most important of which are ERASMUS-PROG1 for the creation of a Master's degree program in computational linguistics and "Collège doctoral francophone" - a doctoral college for the countries of Central and Eastern Europe. She was a member of the Scientific Council of the AUF Francophone University Agency and an expert in engineering and computer science in

the AUF Commission of Experts for Central and Eastern Europe. She was co-chair of 3 international conferences in the field of Artificial Intelligence and a member of the editorial board of two international journals.

7. The materials with which Assoc. prof. Velina Slavova participates in the competition fully satisfy the requirements of the Act of Academic Staff Development in the Republic of Bulgaria, the Regulations for its implementation, and the Internal Regulations of New Bulgarian University for occupying the academic position "Professor".

The above is the reason to give a positive assessment of the materials with which the candidate participates in the competition for "professor" and to confidently recommend to the distinguished members of the Scientific Panel appointed by Order No. 3-RC-20 of 05.10.2022. of the Rector of New Bulgarian University, and subsequently to the honorable members of the Academic Council of New Bulgarian University, to vote for the award of the academic position of "**Professor**" in the professional field **4.6. "Informatics and Computer Science"** to **Assoc. prof. Velina Todorova Slavova, PhD.**

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Reviewer:.....

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