Ontology cognitive ergonomics evaluation based on graph topology

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ABSTRACT

This work describes the new method of ontology cognitive ergonomics evaluation and its automation and implementation.

Categories and Subject Descriptors

I.2.4 [**Artificial Intelligence**]: Knowledge Representation Formalisms and Methods.

General Terms

Measurement, Human Factors.

Keywords

Ontology evaluation, cognitive ergonomics.

1.INTRODUCTION

The problem of ontology cognitive ergonomics evaluation, in other words – ontology perceptibility by people is actual for several reasons. At the time of information society where the creation, distribution, integration and manipulation of information and knowledge is a significant activities, success at any business depends on being kept informed and the ability to use information effectively. Ontology gives an intensional semantic structure that encodes implicit knowledge constraining the structure of a piece of a domain. Thereby it gives people access to systematized knowledge and information. So the question of evaluation of human perceptibility of ontologies comes up.

2.ONTOLOGY COGNITIVE ERGONOMICS EVALUATION

The question of ontology evaluation is one of the pressing problems of ontology engineering. That's why different groups of scientists developed a great number of various methods of ontology evaluation. More than a dozen methods are known by this time and the problem of choosing the appropriate one for the specific purpose becomes more complicated. Classification model of ontology evaluation methods suggested at work [4] gives systematized view. According to this classification all methods can differ on these aspects: aim, object to analyze, means of evaluation, automation level and stage of ontology development. Thus the method suggested at this work can be described in the following way:

- the aim: ontology perceptibility evaluation from the cognitive ergonomics point of view, selection of the best ontology among several;
- object to analyze: ontology structure;
- means of evaluation: analysis of ontology graph topology;
- automation level: automatic or semiautomatic (the decision is taken by an expert basing on calculated metrics);
- stage: development, prototyping, testing.

Cognitive ergonomics questions at ontology evaluation are considered at works [1] and [2]. Gavrilova [2] gives the main theoretical aspects of ontology perceptibility which are based on works of Max Wertheimer in the area of Gestalt-psychology [3]. Reformulated for ontology engineering aims Gestalt theory principles would sound like: "Harmony = conceptual balance + clarity". Where conceptual balance implies:

- concepts of the same level are connected with the parent concept by the same type of relationship;
- paths depth of ontology tree are nearly the same (±2) ;
- general picture is rather symmetric;
- cross-references are excluded as far as possible.

Clarity means:

- minimization - maximal number of concepts of the same level or the path length of the tree doesn't go beyond famous Yngve-Miller's number (7±2);
- transparency for reading – types of relationships should be obvious not to overload ontology scheme and to omit the names of relationships.

Ontology quality evaluation model presented in this work is based on the principles above and mostly adds up to their formalization.

The work [1] gives several metrics which can be used at cognitive ergonomics evaluation, some of them are calculated basing on ontology graph topology.

3.EVALUATION AUTOMATION

The essential property of metrics in the considered method is the ability of their automatic calculation. This fact can significantly simplify the work of an expert at the evaluation of ontology with a huge number of concepts. As an implementation of the method the application OCA (Ontology Cognitive Assessment) was developed for automatic ontology cognitive ergonomics evaluation. The current version of OCA implements calculation of metrics mentioned above, contains a vocabulary where the user can find information about metrics, their purpose and interpretation of their values.

OCA is implemented as console Java application. Calculated values of metrics are stored as attributes of the objects. The work with OWL ontologies is supported with the help of Jena Semantic Web Framework [Jena]. After the startup of the OCA for an ontology in current version all implemented metrics are calculated, results are shown and an expert makes a decision about the quality of the given ontology from the cognitive ergonomics point of view. In the next version it is planned to add the ability to choose metrics to calculate to evaluate the ontology only by chosen parameters. Also it is planned to add automatic analysis of calculated metrics and basing on it results making decision about the quality of the ontology. Moreover, basing on analysis results it will be possible to detect the bottlenecks of the ontology, indicate concrete nodes of the ontology and make suggestion on ontology improvement. Also the function of comparison of two ontologies is going to be added.

4.CONCLUSIONS

Ontology cognitive ergonomics evaluation is significant in case when the ontology is used for education or knowledge sharing. Existing today ontology evaluation methods didn't allow full analysis of ontologies quality and perceptibility by people. The method suggested in this work fills up this gap. Developed application OCA automates evaluation with this method.

5.REFERENCES

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