A Methodological Approach for Designing a Usable Ontology-based GUI in HealthCare

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Abstract/Objective

This paper presents a methodological approach to the design and evaluation of an interface for an ontology-based system used for designing care plans for monitoring patients at home. In order to define the care plans, physicians need a tool for creating instances of the ontology and configuring some rules. Our purpose is to develop an interface to allow clinicians to interact with the ontology. Although ontology-driven applications do not necessarily present the ontology in the user interface, it is our hypothesis that showing selected parts of the ontology in a "usable" way could enhance clinician's understanding and make easier the definition of the care plans. Based on prototyping and iterative testing, this methodology combines visualization techniques and usability methods. Preliminary results obtained after a formative evaluation indicate the effectiveness of suggested combination.

Keywords:

Ontologies, usability, visualization, telemonitoring, care plans

Methods

The design and evaluation of the interface was based on prototyping and iterative usability testing [1]. The actions performed during the prototype testing stage have been divided into a formative and summative evaluation. Cognitive methods for improving users' understanding of ontologies were included in the design. These included maps, tree-tools and zoomable panels [2]. Usability methods were used for enhancing the adequacy of the system for the clinical setting [3].

Formative evaluation was carried out in order to improve the design of the prototype. Two different types of users took part in the study. The first was an engineer with a high level of usability engineering skills. The second was a clinician with expertise in informatics. By using the *Think Aloud* method users were required to verbalize their thoughts as they interacted with the system. The entire evaluation session was recorded using *HyperCam* screen recording software and a Java prototype was used for the evaluation. This evaluation comprised five tasks: 1) *personal interview*, 2) *cognitive walk through evaluation*, 3) users *heuristic evaluation* and understanding tests, 4) *participatory evaluation* and comparative test and 5) *co-design* task of a clinical decision support system (CDSS) for assessing in the design of the profiles.

Results

An initial prototype interface was designed for defining monitoring plans according to our HOTMES clinical ontology [4]. The ontology describes what is termed as a *patient profile*. Defining instances of this ontology, the physician can specify which information should be monitored, its schedule, how to analyse the acquired data and what to do if an alarm is triggered. Rules definitions are also required to complete profiles.

The usability expert, highlighted suggestions related to clarity of wording and to the position and size of the elements displayed. On the other hand, the clinical expert, highlighted suggestions focused on reducing time, and considering context of use. Both users agreed on the utility of the maps to understand what a *patient profile* was and indicated that its functionality should be more visible. After the results of the formative evaluation, two important elements were included in the prototype: 1) a map of the main classes of the ontology as a navigation tool to guide the configuration of the *patient profile* and 2) pre-defined *patient profiles* for speeding up the configuration process and enhancing its understanding.

Conclusions

This is an innovative application of usability engineering and cognitive task analysis that aims to take advantage of the structure of the ontology itself to enhance the understanding of the system while it is evaluated and improved based on its formative evaluation. As shown in the results, users with different backgrounds focused on assessing different elements and this combined evaluation provided useful feedback for redesigning the system. Our methodology could be applied as guide for evaluation and optimization of other applications based on ontologies used in healthcare. Innovations were proposed in the heuristic evaluation and in the participatory and co-design of the CDSS. Future work would include completing the summative evaluation and the final system design.

References

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