A fuzzy approach method for usability inspection

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Usability inspection is the generic name for a set of ways of evaluating user interfaces to find usability problems. Usability inspection focuses on how well users can learn and use a product to achieve their goals. To gather information about usability, practitioners use a variety of methods that gather feedback from users about an existing interface or plans related to a new interface. A wide range of usability inspection methods have been proposed, but few methods focus on developing an objective and practical inspection framework. Moreover, usability inspections are based on human judgments and most methods cannot fully solve the subjectivity of these inspections. In order to remedy this deficiency, this report presents a fuzzy approach method for usability inspection based on heuristics for user interface design and international standards for ergonomics of human-system interaction. The fuzzy approach method was structured according to the following steps: (1) use of a list of 14 ergonomic criteria (table 1); (2) determination of an ideal usability pattern; (3) inspection of the actual usability level compared with the pattern. This method uses the concepts and properties of fuzzy set theory to model the ergonomic criteria (figure 1) and to evaluate the results.

Table 1 - Ergonomic criteria

Ergonomic criteria	Metrics
1. Action-effect consistency	Interfaces should contain measurement units that are compatible with the measured or input variables.
2. Consistency and standards	Users should not have to wonder whether different words, situations, or actions mean the same thing.
3. Aesthetic design	The interfaces should present visual distinction of areas and fields that have different functions.
4. Visibility of system status	The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
5. Colors	The colors used in the interface should allow a suitable contrast when reading functions, display and information.
6. Reading ability	Texts and messages should contain font size, spacing, and positioning appropriate for good on-screen reading.
7. Facilitation	Formatting of the numerical data should facilitate the reading, without the incidence of errors.
8. Minimum actions	Interfaces should contain a fast and simple way for navigation, minimizing the number of steps and the time for the selection of an action.
9. Information density	Interfaces should not contain information which is irrelevant or rarely needed to perform an action.
10. User control and freedom	Interfaces should give the user the freedom to browse and perform actions. Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue.
11.Help users recognize and diagnose errors	Error messages should be expressed in plain language (no codes), and precisely indicate the problem.
12. Protection against errors	The interfaces should present adequate separation between selectable and specific areas in order to minimize accidental actions.
13. Homogeneity and coherence	The characteristics of the interfaces (formats, data input areas) should be maintained consistent from one interface to another.
14. Meaning of the codes	Titles of the interfaces should be distinct from each other, with identification of the icons using appropriate technical terms employed in the task.

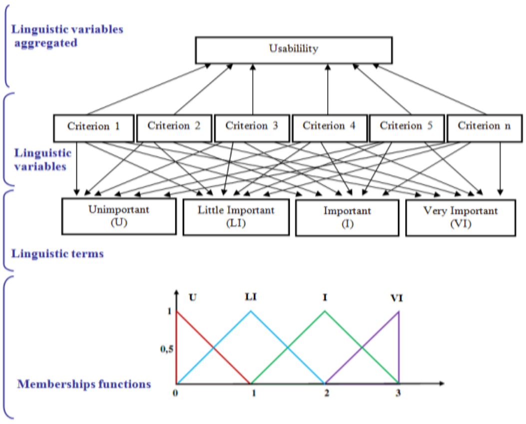

Figure 1. Concepts and properties of fuzzy set theory to model the criteria.

To exemplify the fuzzy approach method we performed a usability inspection to evaluating of the Digital Spectrometer ESP 13004 by testing it with representative users. The ideal usability pattern was obtained based on the opinion of twelve experts in nuclear medical equipment. The usability inspection of the Digital Spectrometer ESP 13004 was performed by ten representative users. The inspection method based on the metrics of the ergonomic criteria presented a compliance degree of the 0.81 with the ideal usability pattern. This result showed that the usability of the Digital Spectrometer ESP 13004 is satisfactory. However, this system presented problems related to three ergonomic criteria: “Visibility of system status”, “User control and freedom” and “Help users recognize and diagnose errors”. We consider satisfactory a compliance degree greater than 0.75, because this value already represent a strongly agreement with the ideal usability pattern. This represents a α-cut at 0.75 of the fuzzy set “ergonomic criteria”. The results showed that the method is a proactive tool to provide a basis for checking usability. The authors gratefully acknowledge the support of FAPERJ.

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