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CRITERIA AND INDICATORS FOR ASSESSMENT OF THE "USABILITY" OF TECHNICAL PRODUCTS

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ABSTRACT

The technical products are getting more and more complicated, integrating both technology and work appliances in their structure. They are everywhere around us and are changing almost every one aspect of our life. Quality of interaction between a technical system and its users was defined in European standards and was called Usability Engineering.

The International Organization for Standardization (ISO) has defined usability like "Effective, efficacious and work satisfaction of users to reach aims at concrete task and environment".

Research in the direction "Usability" are technically, economically, socially and culturally motivated. On its basis specifications of the next requirement: technical, business and consumers are worked out.

Keywords: usability engineering, business, technical, consumer requirement and indicator for usability, effectivity, effectiveness.

Contemporary people are in constant contact with new complex machines and technical equipment. Working with them is not always easy, convenient and successful. Their complexity leads to more difficult operation from the customers. That is the reason for theory and practice to search together for solutions of the problem. More often than not, the technical products are designed to meet the requirements, expressed by customers, in connection with the products' characteristics and functions. Theoretical studies, on the other hand, use the practical experience of designers when dealing with products, meeting the "human" (customers') requirements and develop it into a universal and broadly-used in practice direction called "usability engineering". The direction "usability engineering" is used in the field of producing software products and it also can has place in the design, production and evaluation of technical systems, objects, goods, etc [7].

Defining the terms "usability" and "usability engineering"

"Usability engineering" is direction, which aim is to ensure and guarantee the products' usability. In most of the cases the specialists are with engineering education in the "Human Factors and Engineering Design" direction.

International and European Standard Organizations define usability as "the degree to which specific users can achieve specific goals within a particular en-

vironment; effectively, efficiently, comfortably, and in an acceptable manner" (ISO 9241-11) [10]. In accordance with the ISO definition of usability the following requirements to the systems must be observed:

• effectively – to be able to fulfill the task;

• efficiently – to be able to fulfill the task for minimum time and with minimum effort;

• comfortably – to be a pleasure to work with them!

The costumers' satisfaction from the precise product is a much subjective measure, which should be evaluated by the satisfaction of the individual customer and compared to different customers' levels of pleasure using only one product [5].

The ISO definition of "effectively" means: "the precision and the completeness with which the customer carries out specific tasks."

"Efficiently" is: "accuracy and implementation of the goals connected with increased resources."

B. Shackel defines usability more widely [1]. He includes in the meaning of the term "usability" requirements, which the designed and originated technical system or goods should correspond to: effectiveness, learnability, flexibility and attitude (sometimes that is referred to as LEAF – Learnability, Effectiveness, Attitude, Flexibility). Thus, the terms "usability" and "usability engineering" are naturally connected and they have their growth in one united engineering process of ergonomics design, building, evaluation of effective, efficacious and satisfactory technical products [4].

Criteria and indicators for evaluation of an "usability engineering" property

As criteria and indicators for evaluation of an "usability engineering" property are used many terms, according to the personal preferences of authors [6].

Effectiveness

The effectiveness of one system depends on how the task is executed for an appointed time. For ISO, it is important that the task is done no matter the time necessary for it. Effectiveness can be researched as:

• Success-unsuccess ratio, when the task is carries out.

• Frequency of usage of given commands and language functions.

• Measurement of customers' problems with the system.

• The quality of final product.

The so mentioned indicators are difficult and not enough for accurate measurements. How can success be measured; what is the range of user's reasonable behavior; How to grade or measure user's problems with the system, etc.

Efficacy

The efficient system requires minimum effort, which can be defined with:

• The time necessary for accomplishing certain tasks.

• Decrease in the number of activities, necessary for accomplishing the task.

• The time necessary to search information in documentation.

• The time necessary for on line help.

• The time necessary for error correction.

Errors and their level

Errors and their level are classical measurements of efficacy. If one user can do some task, without errors, then the system will be quicker and more efficient, because it will require less effort. It should be remembered that it is necessary the errors to be corrected, but that will require more time. Before that, the errors can bring disappointment and exasperation, which in turn can bring more and more errors, and waste of time. Error is a term which is used when one action is mistaken. That can be caused by wrong decision or physical confusion and can be explained with the influence of something or someone else. There should be a differentiation between "slip" and "errors". The slip happens when the user knows what to do but does something involuntarily (wrongly) during the task accomplishment. Error is when the user acts unsuitably (he/she does not understand how really one system works).

In the "Usability engineering" directions errors are studied, not slips; although it is possible for slips to arise, because there is too great resemblance between two operations and then it is important to find out what

the reasons for it are. Sometimes slips arise as a result of bad design. P. Jordan makes clarification of errors using a risk scale, starts from minimal and finishes with catastrophic errors [7]:

• minimal errors – they are quickly marked and easily fixed, although they can be boring. Such errors provoke exasperation and it is possible that users start working worse and make more errors after that. Minimal errors have influence on efficacy, but they do not prevent from execution of the task, although they can influence the time factor.

• big errors – such that the user marks and fixes, but there is a great waste of time and the exasperation is much bigger as it is with minimal errors. Big errors have influence on efficacy, too, but they do not prevent from execution of the task.

• fatal errors – they hinder the user to do a particular task. Obviously, fatal errors have influence on effectiveness and efficacy, because they prevent from execution of the task.

• catastrophic errors – they not only prevent from the execution of the task, but also lead to other chain effects. Catastrophes usually begin with small errors, but the effects of them grow like a snow ball and the result is always something very serious. The catastrophic error is not easy to fix, it is rather that the recovery is no possible, if we discuss recovering to the previous situation.

Time

The measurements of the time necessary to do a task and the time lost for fixing errors (evaluation of help, etc.) are also used to evaluate the efficacy of one system. Time is a measure from the beginning to the end of the observed actions or activity.

User satisfaction

The mission of the "Usability engineering" direction is to design systems, which are both easy to use and encouraging users for long and increased usage. The user's satisfaction from working with the system can be measured although very subjectively, with the usage of a questionnaire, using a multistage rating scale.

Learnability

According to all specialists one system should be easy to learn by the user, in that way it will be used more effectively as soon as possible. The ease with which the user learns how to use the system changes the attitude towards it. It should be easy to learn and easy to master, because education is not cheap. This learnability of a system can be measured with the time and efforts necessary for a novice user to learn how to use the system.

Flexibility and attitude

B. Shakel defines flexibility as allowed adapting, (in %) task variation and/or defined situation (i.e. there may be some door that allowed the product to be used not only for the purposes for which it was designed). Adapting of a product depends on the task and situation, in which it will be used, not on the user. The idea is that the product should be adapted to a system and a task, not the opposite. It is possible that different users use the product in different ways – which is a good way to define the product flexibility.

B. Shakel's definition of usability includes attitude, which is a richer criterion than "satisfaction", described in ISO. The system should be pleasant for use; reasonable, longer work with it should lead to increased satisfaction. In other words, users should be satisfied that they use the system and enjoy the activity, they perform with the system [1].

Specification of usability

A significant moment in the ergonomic design of technical systems and goods, in its "user's design" part is the preparation of a specification [5]. A requirements' specification is prepared not only by the ergonomics specialist, it is negotiated with the client, i.e. it is prepared with the end users and it contains terms which are mutually comprehensible for the two sides.

The first task, when the specification is made, is to define the purpose and the problems existent at the moment in the system. The requirements are orientated in three areas: business, technical and customers' requirements [11].

The nature of the business requirements and the needs of the organization requires information about how the system will be used and by whom. The first stage of collecting requirements is the defining of the types of the users.

The technical requirements are defined by what the system should do, its levels of behavior and how it should be adjusted to the already existing system in the organization.

Customers' requirements are defined by customers' profiles; they result from research in the organization, the nature of mission and levels of behavior of the system. These levels of behavior shall help to make usability specialization [8].

Preparing an *usability specification* requires information for the technical system in these aspects:

- To which category or subcategory of users it refers to;
- What are the preliminary circumstances for measurements;
- How will the criteria be measured;
- Which are the criteria for presentation of achievements.

This specification is used as a basis for estimation of technical objects or systems, by the criteria of usability engineering. The process of estimation, redesign and re-evaluation can be carried out until the desired levels and some alternative agreements between clients and the group of contractors are achieved.

An "usability engineering" specification is more complete if it includes effectiveness evaluation of the designed system (goods) for the following possible cases:

- worst case – it is the worst possible case for the system, in this case the system is unacceptable for the customer.
- lowest admissible level – it is the lowest level of conduct, which is acceptable for customer.
- planned case – the level which the system is expected to reach.
- best case – it is the best possible case for the system; it is possible that it is not what the system is expected to reach.
- the level "now" – the present system condition – it is the system, which will be replaced. It serves as a basic level, from which the new system shall be evaluated how it works [4].

The index levels are obtained very easily and painlessly. Present levels can be used for defining the worst case and the lowest admissible levels. Very often customers have a clear idea about what should be improved in a system, so this can be used to set the lowest acceptable levels [6].

A convenient and useful method to compose the specification of "usability" is the *Check-list (control chart)* [7]. Correctly applying the method provides authentic information, which after generalization, applies the following indices for:

- the time, necessary for the task to be done;
- per cent of the task accomplished;
- per cent of the task accomplished for a unit of time;
- success-unsuccess ratio;
- the time, necessary to fix mistakes;
- frequency of usage of on-line help and documentation;
- the amount of time for usage of help and documentation;
- per cent of approving /disapproving comments from customers;
- number of repetition or unsuccessful commands;
- number of good functions, remembered by customers;
- number of unused commands.

The specification of the criteria for "Usability engineering" is created after the customer's requirements for the system are known. When the customer and the expert in "Usability engineering" are satisfied (the requirements are specified) then that part of the contract, which obliges both sides, is finalized.

Assessment of usability engineering

When the system or part of it is built, the measured indices can be applied and after that the results can be analyzed to check if the specification has been fulfilled.

The direction "Usability engineering" requires its users to do their task or tasks by using designed and built technical system. Activity implementation is evaluated in different ways:

• the user can implement the task. Appraisers then can measure the activity by using a common check-list.

• users are observed how they use the system and then an evaluation is made. That gives an opportunity for observation of encountered difficulties and the way in which these difficulties are solved.

· appraisers can make interviews to obtain the necessary information. This is a good way of collecting information about users' satisfaction with the system. Similar approach is the use of questionnaires.

Usability engineering indices and criteria are part of the evaluation process. They do not replace the testing with users. These are measures which collect information about task implementation.

All decisions about the usability of one technical products or system are taken by the usability engineering specialists. The idea of the direction "Usability engineering" is to facilitate transforming the design process into an open and patent process and to enforce the measurement of the results according to preliminary agreed – upon criteria. Transparency, when decisions are taken, is guaranteed by including an usability engineering specialist in design groups. In the same time these specialists report for users' needs and problems which arise during the process of design of the system or goods.

In conclusion, it may be said that the usability of technical systems and goods can be defined if suitable methods and resources are used. This can be achieved by:

• defining of usability by using indices/measurements;

• defining planned levels of usability on certain indices;

• including a feedback form the user during the design process;

• repeating all aforesaid steps, until reaching the levels of usability, which are recommended or the steps are changed with user's agreement.

The purpose of the usability engineering approach is to define exactly what means technical goods to be successful from human point of view and how this can be measured. In practice it is necessary to report for many measurable characteristics and parameters that meet the users' needs.

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