AN APPROACH TO DESIGNING THE INTERFACE OF THE AUTOMATED DOCUMENTARY SYSTEM

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Abstract: In the paper the procedure for calculation, designing and estimation of the ergonomics of the interface of systems of document circulation is considered. The original computation procedure and the data received during the designing of the interface of documentary system are given.

Keywords: Designing of the interface, design, ergonomics.

Introduction

The increasing complexity of the solved by the computer systems problems demands higher requirements for their productivity and speed. However for the increasing of the productivity and the operating speed of the computing systems it is not sufficient simply to extend the CPU clock, data bus width or the capacity and the quantity of HDD.

The operating speed and the productivity of the computer systems or “human-computer” systems depends not only on the computer productiveness or the processing speed (the speed of input of the information/commands) of the user but also on the clearness and completeness of the information, presented by a computer; how "clear” will be the user commands to the computer.

Let us consider the “human-computer” system on figure 1.

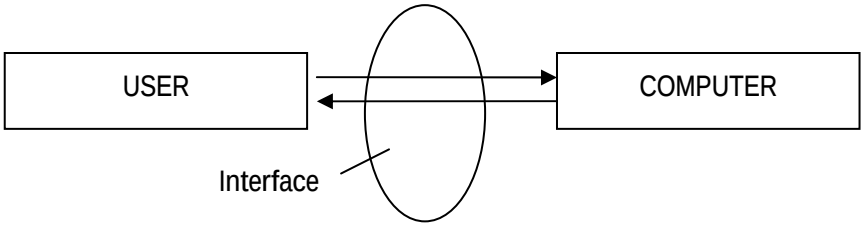

Fig. 1

The computer gives information, on the basis of which the person – the user – makes a decision and performs control action on the computer. The computer executes commands and gives the new, actual information on the basis of which the person makes new decision, etc. The productivity of the considered system will depend on how ergonomically the human computer interface is realized.

There are various techniques that allow the quantitative and qualitative estimation on the ergonomics of the interface. In the paper the problems of estimation and designing of the interface for the automated documentary system are studied.

Techniques for estimation of the interface ergonomics

The following methods are used for the interface ergonomics estimation:

1. Method of expert / subjective evaluation

The interface ergonomics estimation is carried out by a group of experts on the base of their personal operational experience. As the experts evaluate the interface in different ways on the base of their own subjective criteria then it is advisible to involve several experts (it is recommended to take three up to five experts, because too many experts increases the complexity in the analysis of the received information).

2. Testing - the comparative analysis

The users take participation in the testing. The aim of the testing is revelation of typical mistakes from the user side during working with the program interface. It is advisible to propose different variants of the interfaces in order to the user can choose the most ergonomic one.

3. Quantitative methods – multicriteria analysis

The speed of work of the user, the speed of training and the quantity of the mistakes are the basic characteristics of the ergonomics of the interface.

Traditionally the GOMS model (the model of goals, objects, methods and selection rules) [1] is used for the quantitative estimation of ergonomics of the interface. The GOMS modeling allows predicting and forecasting what amount of time will be needed by the user for performing particular operation by using the given interface model.

According to the GOMS model the time that is required for the accomplishing of some task by the system "user-computer" is a sum of all time intervals which were required for performing a sequence of the actions that correspond to the components of the given task.

The GOMS method gives good quantitative estimations for different variants of the user interfaces. In practice the developers use expanded models, such as, CPM-GOMS (critical-path GOMS method), in which additional parameters are considered.

For evaluation of ergonomics of documentary systems it is expedient to use a set of coefficients together with the GOMS model followed by multicriteria analysis.

The mentioned techniques are good enough for an estimation of already created interfaces, but it is difficult to apply them to the designing of the intefaces.

Technique of designing of the interface

Let us consider a technique for the designing of the interface on example of the automated system of Documentary Maintenance of Management (DMM). The interface of the considered automated system represents a sequence of screen forms with some fields. Part of the fields is filled by the user and another part is filled automatically.

Each field can accept a final number of values. The information of some screen form can be evaluated. We shall measure the information of the screen form as entropy reduction. That is, considering the screen form before filling (when its condition was indefinite), its entropy was $H(X_i)$. After filling all fields (the condition was completely defined), entropy becomes equal to zero. Therefore, it is possible to define the information received as a result of filling all the fields, as

$$I_X = H(X_i) - 0 \quad \text{or} \quad I_X = H(X_i).$$

All possible states X_i of the screen form with their corresponding probabilities P_i are represented on the table 1.

X_i	x_1	x_2	x_3	x_n
P_i	p_1	p_2	p_3	p_n

Table1

According to [1] the entropy is defined as

$$H(X_i) = -\sum_{i-1}^{n} p_i \log p_i,$$

where the logarithm on the basis two is used. For the considered screen form we define the following characteristics:

- the total quantity of screen forms according to [2] should not to exceed $J = 7$;
- the quantity of fields with scrolling should not exceed $K = 5$;
- the quantity of input fields (supposing input no more than five symbols) should not exceed $L = 4$;
- the quantity of input fields with help (i.e. such in which the system carries out input of a word under the two first letters) should not exceed $M = 3$;
- we shall enter into consideration some coefficient R_i describing time spent by the programmer on the development of the given element of the interface;
- to each type of a field we shall put in the conformity some coefficient t_{ij} describing time expenses of the operator for filling of the given field. Then the general time for filling of the given screen form will be:

$$T_i(J) = \sum_{j=1}^{J} t_{ij}$$

Under these conditions, for the given concrete case it is possible to formulate criterion of productivity for the interface:

$$H(X_i) \to \max$$

$$T_i(J) \to \min$$

The results of the analysis of the input fields that is made in conformity with criterion of productivity are resulted in table 2.

Type of a field	Choice from the list	Input with the help	Input without the help
Description	Before information input all three states are equiprobable, that is why [1] $H(X) = \log n$	In unknown three words we are interested in combination of five letters in twos. The number of possible equiprobable states is 10.	Combination of five letters from 32. Number of possible equiprobable states is 32^5
Numerical value	$H(X_i) = \log 3 = 1{,}584$	$H(X_i) = \log 10 = 3{,}321$	$H(X_i) = 5 \log 32 = 25$
Coefficient, describing the time spent by the programmer on the development of the given element of the interface	1	3	2
Coefficient, describing the time for filling of the field by the user	1	1,5	2

Table 2

Conclusion

According to the data from table 2 the following recommendation for the designing of the automated documentary system interface can be formulated: on the base of productivity criteria, time expenses of the user of the documentary system for filling forms and time expenses of the programmer-developer for interface creation in the considered interface it is advisible to use:

- number of fields with scrolling *K = 3*;
- quantity of input fields (allowing input no more than five symbols) *L = 2*;
- quantity of input fields with help (i.e. such in which the system carries out input of a word under the two first letters) *M = 2*;

Thus, *J = 7*, i.e. the total amount of screen form fields in accordance with [2] is equal to seven.

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