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USER INTERFACE MODEL OF INTERACTIVE EDUCATION SOFTWARE

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ABSTRACT
The research area of this work represents interaction of a human and a computer, HCI. This research represents the contribution in the field of projecting and implementation of the interactive educational software from the view of the role of the user interface. The research should offer answers regarding roles and effects of the user interface in interactive educational software as well as the answer to the fact how its different shape influence the addoption of the important information relevant for the extention of the user knowledge.
This paper represents the results of researching conducted upon Fitts law and its applying on the designing of user interface as a component of the interactive educational software.
Keywords: HCI, user interface, software

1. INTRODUCTION

The research area of this work includes human and computer interaction (Human Computer Interaction - HCI). HCI can be defined as "a discipline which refers to projecting, evaluation and implementation of the interactive computer systems used by people when the main phenomena which surround them is being studied. HCI also studies assignments performances done by people and computer together, human-computer communication structure, sociological and organizational interaction during computer system projecting, human ability to use a computer (including the possibility to learn), algorithms and programming the interface itself, engineering problems which show up during the projecting and interface making and specification process, projecting and interface implementation" [1].
Human and computer interaction also deals with comprehending, shaping, evaluating and implementation of the interactive computer systems intended for the human usage [1], and all that in order to provide applicable and functional computer systems.
The main problem arises while shaping the user interface and the technical realization of it – systems that will simplify and make more efficient the communication between human and computer, directed to the completion of the wanted task, and which will at the same time contain the transparency necessary for developing the user being unburdened with the interface itself [2].
Altogether, the area of human and computer interaction has only one aim – to reach and secure the user with the great computer usability of the supported systems. Usability is the main concept of human and computer interaction occupied with the way of the system realization easier and simplified for studying as well as for the usage [1].
Usability engineering, i.e. the process where it is quantitative specified the product usability, and in the wide range it has become the organized discipline with the set principles and determined standards. It is obvious that for the each individual, communication with computer has become at least so important as the processing itself. However, many poorly designed computer systems point on the difficulties while designing the usable way of human and machine interaction [2].

This research presents the contribution to the field of projecting and implementing the interactive educational softwares from the point of view of the user interface role.

2. THEORETICAL APPROACHES OF RESEARCHING

2.1. Problem and subject of research

Empiric research proves presence of tendencies when we talk about developing and applying new models of teaching and learning helped by modern IT, but first of all, interaction of a man and a computer, where users (people) will be in the centre of the communication.
Research gives the answer about the role and the effects of user interface in an interactive ES. It is also important what forms of ES actually affect the information acceptation, which is relevant to emphasizing users' knowledge. The problem is complicated by its own; it has many functions in a wide row of processes in science, society and education or relations between them.
This problem is not just pedagogically founded, but also cybernetic, psychological, socially. Theories and projects in the field of man-computer-interaction are giant and various. Software that are available at the very moment depend on hardware characteristics. Here is the aim to create software that depends on users. Further, a universal model of user interface is being researched – no matter what a research field, age of a user or his/her computer knowledge are.
If we want to be specific about these researches, we need to explore advantages of user interface in the following:improving educational effects of ES, developing cognitive, affective and sense and movement skills.

2.2. Mathematical calculations

Preschool children do not use a mouse well, and it is recommended to create big icons on the screen, where children can approach easily. On the other hand, they should be able to click on a specific surface and the mouse keys all should be given the same function. The technique drag-and-drop should be avoided.
Now is time to present some theories as projecting background and defining model of user interface in interactive ES. Fits rule helps a lot, which gives calculations of time used for moving targets, according to their size and distance.
The model let us conclude that time used for moving target (MT) is inversely proportional to target width (W), and directly proportional to the distance of target according to the point of starting (theoretically, target is on a starting position of more heights) (A), (Fitts, 1954).
The formula that comes from the Fitts' law is:

$$ID = \log_2 (A/W + 1) \quad (1)$$
$$IP = ID / MT \quad (2)$$

where:
ID – index of complexness and
IP – index of performance.

Index of complexness represents the work used to get the target (the same ID can be calculated with different combinations of A and W)
Index of performance represents the quality of users' performances in experimental conditions. It can be used when researching different groups of users in same conditions (e.g. adults and children) or their performances in different conditions (e.g. usage of a mouse instead of touchpad). [4]
The results of Hourcade's researching show that software aimed at very young users should follow the concept of a mouse usage – both keys on a mouse have the same function. His conclusions lead us to the fact that objects motion speed should be acceptable, because slow motion of objects can make users very unhappy. Designers should use simple interactions according to the age of users and their abilities. Software for children should be designed in that way so that there are a small number of icons and they should be bigger. Creating age groups is not very easy and it is not the same when making software for children of 9 and of 3. Also, it is not the same creating software for children of 6 who have already experienced using computers and for ones who have never used a computer. [4].

3. REALIZATION OF USER INTERFACE MODEL IN INTERACTIVE ES

There has been a lot of experienced work in creating ES and in assisting by term papers or final exam works as well. The scientific researches have been made in the field of IT experts at The Technical Faculty "Mihajlo Pupin" in Zrenjanin; professor of informatics; the subject name Projecting ES. It has always been the same conclusion that the following components affect knowledge improvement: user ability to use software, complexness of tasks, predicted time for solving problems, percentage of achieved goals.

While processing user interface creation we have selected 5 related modules, which are structurally very close to each other: module of introductory animation, module of presentation part of ES, module of testing part, module of helping hand, module of ending animation.

During the realization of the model, it has also been created interactive educational software, which represents the practical work of the theoretical part of this research. The preliminary phase of software realization has assumed the topic according to the age of users. The model has been divided into 5 modules. One of the reasons was the need of a user to know which module he/she is in, what he/she is expected to do. Users need to understand software organization and clear picture of module system. Users need to know where every module begins and ends at every moment. Every module has its goal and purpose.

MODULE OF INTRODUCTORY ANIMATION gives users instructions for software usage over sounds and speech (it is assumed that users, here preschool children, cannot read or write, so there is not a single letter on the screen). This module can be skipped at every moment by clicking on the screen, no matter where. This is of a huge importance, because users do not have to listen instructions all over again, especially when they learned how to use software. Contents are presented to the users. During the introductory part, there are measurements of users' performances and users can get the information back. This is something very new according to previous educational software.

MODULE OF PRESENTATION PART OF ES is created in two forms: presentation with moveable objects and presentation with non moveable objects.

MODULE OF TESTING PART requires changeable knowledge tests, which means adjustable to users abilities. After getting the IP during the introduction part, there are 15 tasks to be done. They are all same in design and actions, but different in movement speed of objects. Users are divided into three groups: where IP is 50 – group 1, where IP is between 50 and 100 – group 2, and where IP is over 100 – group 3. Time for testing is limited to 3 minutes.

Besides that, marking their work depends directly on IP, which was not the case until now. Marks simply depended on true answers before, which cannot be the general mark considering learning with educational software. Users are divided into 3 groups, where the speed of objects' movements in the group 3 is three times slower than the one in the group 1. This type of testing in educational software is important, because not everybody has the same ability to solve the problem. That can have an effect on learning. Intellectual abilities are not of great importance here and because of that, we use this type of evaluation.

MODULE OF HELPING HAND is created to be available all the time when educational software is used. Before starting each module, there are instructions for users, which represent what is expected from them and how they should use software.

MODULE OF ENDING ANIMATION contents information about the author(s) and program package, which was used to create the software.

4. EMPIRIC RESEARCHES

There is a large number of preschool children in Vojvodina and there are also a lot of kindergardens. Zrenjanin has been the choice for empiric researches and Novi Sad and Subotica are next to prove the results. Research has had 5 stages:

first stage: creating group of software, which are not related to the new model of user interface. The software mentioned here is educational software, researched in works of students at "Mihajlo Pupin" Faculty in Zrenjanin. Most of them are term works or final exams on the 4th grade of Informatics Teacher Studies, the subject course Projecting the educational software. All of them are from the field of mathematics;

second stage: interviewing users about their experience with the computer, if they have it at home etc.;

third stage: creating the software for counting the IP of users;

forth stage: creating software with the same purpose like the ones from the stage 1 but using a proposed model of interface on them;

fifth stage: creating the software after evaluating with possible changes; this stage suppose presentation of new software, created after corrections. The topic are *shapes and colours learning* as fundamental knowledge in the field of mathematics and *developing the logical thinking* at preschool children.

The preliminary research, which included preschool children from Zrenjanin, had as its aim to discover learning with computers. The children were presented software from the field of mathematics, which are created at the "Mihajlo Pupin" Faculty in Zrenjanin. They were also shown a new prototype of a user interface model, according to the rules described in previous chapters of this work. The prototype attracted attention, because children never thought to be learning basic shapes and colours but playing some new game.
For the research a new group of users were formed: 139 users aged 6-7 (79 girls and 60 boys). They are all from preschools in Zrenjanin. Both groups answered the questions about using the computer at home, before they used software for measuring their IP.
We found out that 90 users have their own computer and only 30 have never used one. IP of users was counted according to their ability to "catch" an object, which is 70p wide and moves at 50p/s during the short period of 30s. Researches showed that all users were able to click the object at least once, which is enough to confirm that the object has well selected size and not at high speed. The average IP value was 51,08.
After getting the average values, we could approach to the experimental researches. First, the children used software, which is not based on the model of user interface. That software was created in the first stage. After that, they used software based on a model of user interface. Now the time is limited to 10 minutes for using the software and to 3 minutes for testing part, as in the previous group of software. It is very important to limit the time for testing part, because we wanted to examine the ability of a child to answer the questions as quick as possible.
Based on IP results we created 3 groups of users in the following way:
the first group of children with IP below 50
the second group with IP between 50 and 100 and
the third group with IP above 100.
Users can check their improvement in this, most effective way, which is presented in module of testing part, described in previous chapters of this work.
To give children opportunity to use their best performances, the objects speed was corrected in the following way:
IP (1-50) - Movement speed of object 25p/s
IP (51-99) - Movement speed of object 50p/s
IP (>100) - Movement speed of object 100p/s
Objects in group 1 moved ½ slower than expected when counting IP, while the children in group 3 showed a very high IP, where objects moved twice as expected.

5. CONCLUSION

The results of these researches are showing us the importance of bringing in new models of user interface in ES. Finally, authors find further researches very reliable when speaking of good quality at ES. These results will be used in the future, especially in the field of projecting the ES at the Faculty M.P. in Zrenjanin. It is good to be made aware of that, in which way software is created when we work with young users. For preschool children it is necessary to create software of the best quality and to avoid the wrong approach when starting the usage of IT.

6. REFERENCES

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