Efficiency in Performing Basic Tasks Using Word Processing Programs by the Elderly as a Measure of the Ergonomic Quality of Software

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Abstract. Computers and the opportunities they offer are no longer the domain of the young, and the ability to use a multitude of computer software has become a basic skill both in private and professional life. Therefore, it is no wonder that increasing attention is paid to the design of interfaces adapted well to groups of users with specific needs, like the elderly. Such measures are broadly reflected in scientific works, however, commonly available software is rarely marked by an adequate concern for the needs of seniors. Additionally, the elderly usually gain access and opportunity to work on a computer during old age, being outpaced by their younger, and somewhat more predisposed to computer technology, colleagues. The prevalence of computer needs and growing number of elderly people means that seniors are condemned to using computers. How effectively and enthusiastically they will use them will be largely dependent on the ergonomic quality of the offered software.

Keywords: elderly design, ergonomic evolution, software usability.

1 Introduction

Working with programs such as word processing is the most common operation performed during typical office work and private activity. The software that is used for this purpose is largely a different variety of Microsoft products [14]. However, the need to sell next editions of the program requires continuous changes that do not always meet with enthusiasm of users. Especially older users are resistant to such alternations as they became accustomed to certain solutions and such a situation may create a considerable consternation. The problem has become even more serious because the population of the elderly is increasing year by year. For example, in Poland in 2011 nearly 35% of the population has exceeded the age of 50 years (34.89%)[19]. It is expected that in view of the ageing population this percentage will grow, which will also affect the labour market. In addition, the extension of working time will cause that more and more elderly people will have to perform work that has been previously carried out by much younger people. This results in a much higher demand

for solutions with the right level of ergonomic quality [5]. Solutions of this type will be needed at each stage of production [10]. Aging of workforce will also affect office workers who use a variety of software, including most often text editors. The purpose of this article is to present the studies that have been undertaken in order to verify differences regarding particular solutions concerning text editors for the elderly in the context of work efficiency.

2   Literature Review

The use of a computer is caused by a need, but also contributes to the improved well-being of older people who got familiar with the computer technique, which has been shown on 222 older adults in south Florida. It indicates that players awaiting a tournament start are more computer savvy and more self-satisfied with life [11]. As elderly persons increased their experience with computers, they achieved more positive attitudes toward a computer technology [6]. Lack of interest in the computer techniques does not result from the inability of older people to use the computer techniques, but it is due to the fact that they lack the habit and do not see the need for it-elderly people are just as technologically savvy as the rest of the population [17]. Therefore, there is a demand for adapting the software to their needs.

Designing ergonomic interface of any program that is friendly to the elderly people requires, like all kinds of different items, the principles of universal design. Among a number of publications on the subject [3], [4], [15] ones that should be mentioned are those relating to the problem of transferring the principles of universal design for usability [7]. Among the features that must be met are: effectiveness, affordability, reliability, portability, durability, securability, physicalsecurity/safety, learnability, physical comfort, acceptance, ease of maintenance/repairability and operability.

Among reported trials to examine how older people work with typical office software it is worthwhile to cite a study conducted on patients of a nursing home [12]. The experiment that was carried out with office software exposed dialectal difficulties in understanding instructions and texts. The subjects had particular problems with the word "cursor", with many other terms (e.g. "backspace", "page up = down", "enter", "ctrl key", "alt key" "ESC" and function keys) were confusing, and players awaiting tournament start could not remember their relative functions [12]. For those who did not have any previous experience with computer technology the biggest problem was double-clicking the mouse which was probably the most difficult manoeuvring task to learn in a menu-driven environment. In the case of writing texts, the problem was a size of the cursor, which exceeded the size of the text in too little extent to be recognized. This problem is present in a wider problemacy range of control accuracy and abilities to recognize small objects by the elderly [9]. An additional factor which limits the efficiency of the implementing these steps is stress resulting from contact with new technical equipment [1], which may additionally curb the efficiency of the performed activities.

3   Research Method

Numerous authors have isolated three areas of IT product quality - internal quality, external quality and quality in use. Internal quality is the "core" of product quality, which determines the quality of other areas. It's a static design quality dependent on code, programming style, etc. External quality refers to performance and behaviour of the product regardless of the user. This quality is expressed by dynamic characteristics of the operating product. Both internal and external qualities are potential – they characterize quality before application and evaluation by the actual user. However, quality in use (QIU) is defined as the ability of software to enable users to achieve specified goals with effectiveness, efficiency, security and user satisfaction in a specified context of use. QIU is observed by the user and measured by the result of software application, rather than by its inherent qualities. QIU is therefore a resulting quality and characterizes an IT product in the broad context of use in order to perform real tasks in a real work environment.

As a direct result of the design process, the internal and external qualities influence QIU, but are not themselves indicators of the overall quality of the product.

To evaluate usability, methods based on observation and measurement are used, with the most popular including heuristic evaluation, usability inspection and usability testing.

A previously developed model of testing QIU [16] is used during research, in which group criteria are expanded to precisely defined elementary criteria. The developed criteria are supplemented by rules from principles of universal design and persuasive design. Thus, for each of the criteria groups a set of detailed sub-criteria is created. A set of group criteria included:

— Easiness of use
— Error tolerance
— Comprehension
— Using fastness
— Usefulness
— Adequateness
— Ease learning of use
— Accessibility
— Self-descriptiveness
— Integrity
— Aesthetics

Typical word processors are analyzed, accounting for changes in ergonomic quality in consecutive versions of software. For this purpose, the program versions are tested in variable order. The study selected the most commonly used word processing programs, which are an example of a computer tool independent of interest or age. The execution time of basic tasks, saved as user instructions with no technical hints, is used as a measure of efficiency. Tasks are designed with three levels of difficulty.

1. The first level – entering a simple text and its formatting which was limited to paragraph alignment, modifications of the font type and size along with its bold,

italic, underline and line spacing. Other features of the document remained unchanged, according to their initial settings.

2. The second level – additionally took into account paragraph formatting, page settings, zooming and inserting the table.
3. The third level – additionally took into account an application of styles, inserting graphics, page numbering, inserting a table of contents and other features. The use of advanced features could be preceded by searching the help system.

At each of these levels a number of elderly people aged over 70 years were examined. These people had varied levels of experience, starting from the smallest, and so those who had no previous contact with the computer or their contact was limited to occasional and random activities, in comparison with the people who previously used the editorial programs for writing documents. For research the method of ethnographic research, which includes participant and nonparticipant observation, focus on natural settings, use of participant constructs to structure the research, and investigator avoidance of purposive manipulation of study variables [18]. The implementation of ethnographic design was used to see discrepancies between verbal assessment of the user and the real way of task implementation [2]. In the highest level of difficulty, a comparison is made with a control group comprised of persons under the age of 40 years.

4   Results

The first level of task difficulty was designed for people who have never created documents in a text editor. As might have been surmised, these subjects were focused on the introduction of characters and any unpredictable software reactions aroused concern. In the case of this group, the differences between the older and newer Microsoft Word software interface did not have greater importance.

For this group of users the criterion for Easiness of use would be best met if it was possible to hide most of the options. Their number scares inexperienced older users. A typical element of the intuitive operation is a ruler, however, the required precision makes it difficult and sometimes even prevents the use of it by the elderly.

Another criterion, Error tolerance should involve, for example, blocking the function of replacing the selected text, and moving a text by means of the mouse. The criterion called Comprehension and Adequateness was more acceptable when all the settings were similar to what the users associated with the final version of the paper document.

Therefore, despite the need to reduce the size of the font display, users wanted to work in print layout view with visible edges of the page. It should be noted that this system is also preferred by young users.

The criterion of Self-descriptiveness could be evaluated by novice users on the level of the subtitles displayed after moving the mouse cursor on the selected item. In this case, the new interface of Microsoft Word 2007 version and higher was better assessed due to more elaborate descriptions.

Because of the simplified interface resulting from limited functionality, the most appropriate for this beginner group of users is considered WordPad program which is a component of Windows accessories. This choice applies to the modified version available in Windows 7. Versions that were previously available in Windows XP and

Windows Vista – were not accepted by older users due to the lack of possibility to work in the system of visible edges of the page.

The second level of task difficulty was designed for people who previously dealt with writing text documents on a computer. These people could already better evaluate the meaning of different interface versions. The preferred version was traditional interface with toolbars, where the selected stripes are constantly displayed and execution of other commands requires checking the menu or short-term display of additional bar, for example, the Tables and borders toolbar. Some users claim that a banner with hidden buttons proved to be such a big problem that when they do not see a certain group of buttons, they simply do not use it. An example of such unused function in the new interface is the zoom view, previously easily available in the standard bar.

Most of the ratings given by the users of the first group were confirmed by the people from the second group. In addition, due to the use of a greater number of features, this group could refer to a bigger amount of features. The Accessibility criterion has been assessed in terms of the assistance available in particular dialog boxes. The function that was highly rated was the help assistance available in the windows dialog box for MS Word 2003. Analogous help of the newer versions was assessed by the users as not fully linked with the instructions to which it was attached.

Variability in the size and position of the command on ribbons at different screen resolutions, and even the change of the window size was considered a characteristic worsening the assessment of a criterion called Ease learning of use. For this reason, many users must again seek the position of well known commands.

The third level of tasks difficulty was intended for people who use text editors more often. Most of the earlier assessment was confirmed, although simplifications that were given for first group do not apply to them and a help system in each version is treated as useless.

This group of older users was compared with a group of people under the age of 40. Table 1. presents a summary of the assessment results in the percentage (0-100%) of the satisfaction level of elderly users whether their expectations were met in each group category. Table 2. contains an analogous correlation for younger people.

Table 1. Satisfaction level of the elderly users regarding their expectations in particular group categories

Group criterion	MS WORD 2000-2003	MS WORD 2007-2013
Easiness of use	83%	78%
Error tolerance	80%	79%
Comprehension	93%	86%
Using fastness	95%	81%
Usefulness	94%	84%
Adequateness	89%	78%
Ease learning of use	87%	75%
Accessibility	81%	74%
Self-descriptiveness	82%	82%
Integrity	91%	73%
Aesthetics	89%	95%

Table 2. Satisfaction level of the younger users regarding their expectations in particular group categories

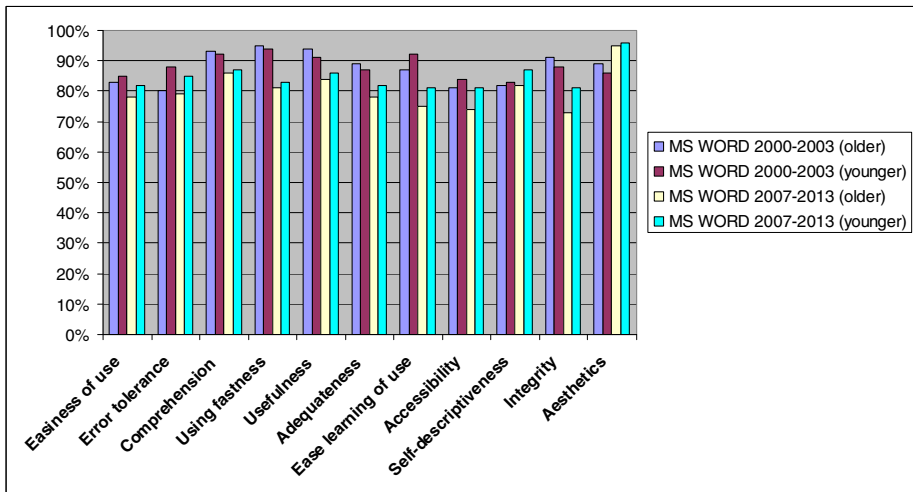| Group criterion	MS WORD 2000-2003	MS WORD 2007-2013
Easiness of use	85%	82%
Error tolerance	88%	85%
Comprehension	92%	87%
Using fastness	94%	83%
Usefulness	91%	86%
Adequateness	87%	82%
Ease learning of use	92%	81%
Accessibility	84%	81%
Self-descriptiveness	83%	87%
Integrity	88%	81%
Aesthetics	86%	96%

Fig. 1. Satisfaction level of the older and younger users regarding their expectations in particular group categories

Summary of the results from table 1. and table 2. is described in Figure 1.

5   Conclusion

Many elementary conclusions were mentioned in the description of the achieved results and made observations. For users who in the past did not use text editors, all interfaces regardless of the WORD program version and WinWORD proved to be too complex. Their expectations were aimed at searching for much simpler program that involves little precision in operating the mouse. It turns out that the assessment of a given criterion also depends on the users level of expertise and experience to use a

particular software. In order for the impact of this experience on the differences between the elderly and the control group was the smallest, the control group of younger users were people with similar experience. This problem is typical for the cross-sectional studies and is associated with a cohort effect.

By comparing the results of evaluations between versions with an older and a newer interface, it can be concluded that, in general, the old interface had better evaluations. The exception is the criteria of *Aesthetics*, which was assessed similarly both by younger and older people as more efficient. It ought to be noted, that the assessment of younger people only slightly differentiate evaluations for both interfaces.

For the elderly those differences are larger and can mean that it is more difficult for them to adapt to new solutions. Younger people with a lot of experience better cope with new trends, often treating them as a challenge for their intelligence, and thus are not critical of the software creators new ideas. Older people require, however, a much stronger stimulus to overcome fear of new technology. The solution can be manuals written specifically for seniors to learn WORD [13], [8].

Materials from these books take older adults step by step through the basic features and the entire new tab format of the program. Such an approach will definitely help many senior to overcome their fear and will enable them to acquire new skills and develop their independence.

Most seniors and beginner computer users will use Word for typing a letter to a family member or friend, typing up a recipe or creating a fun card or flyer.

Research found that most office software insignificantly reflects the needs of the elderly. Among the most significant problems are small intuitiveness of operation and small tolerance for error. Elderly people have navigation problems and take an increased amount of time to discover unknown functions than in the case of younger people. An important factor is the tendency of software producers to modernize and move away from previously developed schemes. For elderly people who utilize earlier versions of software the "modern design" of the following versions becomes a major obstacle to effective work. A particular obstacle is a program's drop-down menu, which requires considerably precise motion of the computer operator. The efficiency of performing work is proportional to the perceived ergonomic quality of programs. The biggest impact on the results has the intuitive operation of the program – its ease of use.

In summary, with the increasing proportion of elderly people in Polish society and the dissemination among them of computer technology, there will be an increase in the demand for senior-friendly computer programs. Even when taking into account technologically-advanced future seniors, this group due to declining organ reserves and cognitive abilities will experience deficits in the ergonomic quality of programs, costing them a reduced efficiency or even an inability to work with a computer in its current form. Moreover, even seniors experienced with computers are exposed to exclusion due to rule changes of program interfaces, which also indicates the need to develop methods of design with a focus on elderly people.

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