

# User interface design question in developing multimedia software for handicapped children

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## Abstract

The multimedia and virtual reality projects of our Laboratory performed during the past ten years can be summarized as follows:

- Tutorial and entertainment programs for handicapped children
- Rehabilitation programs for stroke patients and persons with phobias.

We have developed multimedia software for handicapped children having different impairments: partial-vision, hearing difficulties, loco-motive difficulties, mental retardation, dyslexia, etc.

The experience of more than one decade is shown in this paper. More than 30 programmes were developed during the last ten years.

**Keywords:** multimedia, special needs, rehabilitation

## Introduction

Most of the software engineering companies do not develop programs for special users, because they do not see fantasy in this poor market. But 10% of the population around of the world are handicapped. The data in Hungary are the following: 450000 children are learning in special education institutes, 300000 people are hearing impaired, 45000 blind people are living in Hungary (the number of visually impaired people is unregistered) 174000 adults and 25000 children have loco-motive difficulties, 300000 – 400000 children are mentally handicapped and 10000 people are seriously handicapped. The present inhabitant number of Hungary is 10 Million.

In the USA about 14% of the population suffers from disabilities. This number is 50% for people older than 65 years of age [5].

There is no common definition of “disability” across Europe and some Member States do not have statistics on the numbers of people with functional disabilities. Where figures do exist, they are always linked to eligibility to benefits. Available figures date from 1999 and are based on people who have reported being hampered “to some extent” or “severely” in their activities: it is subjective, and there are huge differences between countries, which can be accounted for by the differing attitudes toward “well-being” and “disability” across Europe. In 1999, 18% of the EU’s total population reported “severe” or “moderate” impairment in their daily lives, of whom 7% reported being “severely disabled”. Disabilities are strongly linked with age, and our societies are facing with a growing number of people aged 75 and more, who are more likely to have impairments or disabilities. This group will

comprise 14.4% of the population in 2040, against 7.5% in 2003 – almost a twofold increase. Around 45% of those aged 75 and over reported (in 1999) being impaired in their daily life, either physically or mentally, of which 27% reported that they were very severely impaired [1]. Anyway according to the forecast in Europe at least 18% of the population will be disabled during the next 20 years. The present number of the European population is 450 million. This means that more than 81 million people will have disabilities by 2040. This is not only because the very early premature babies are rescued by modern medicine, but there is growing the number of elderly people in Europe. The present middle aged group, that is using the computer today for its work or entertainment will go into old age,. It is the time to realise the problem and to get ready for the solution. One must not forget, what we will expect if we grow old. Design such a word that will help us!

Obviously, it is not a simple task to assess the effectiveness of a multimedia teaching system. There are some organizations, which published techniques for the evaluation of multimedia teaching software [3,14]. The question is more complicated if the users have special needs. The literature is increasingly attentive to „Design for All” principles [2]. Several conferences run on this topic, the most important ones are the following:

- International Conference on Computers Helping People with Special Needs  
It is staged in this year in Paris (<http://www.icchp.org/>).
- International Conference Series on Disability, Virtual Reality and Associated Technologies, it was staged in Veszprém (Hungary) two years ago, and it is staged in this year in Oxford (<http://www.cyber.rdg.ac.uk/ISRG/icdvrat/home.htm>).
- The Association for the Advancement of Assistive Technology in Europe (AAATE), was in Dublin in September 2003 and will be staged in France in 2005 (<http://atireland.ie/aaate/aaate.htm>).

We have discovered the basic design questions that have to be taken into consideration for special users only after a long developing and research work.

### **What are the advantages of multimedia software to develop handicapped people's skills?**

- It is an audiovisual medium.
- It is interactive.
- The treatment or situation can be reproduced, the same condition can be repeated several times.
- The display presentation can be set according to the visus. The size, form, contrast, colour, size of line width, etc. of the objects and the background can be selected for best suiting the patient.
- It can be adjusted to the individual needs.
- Multimedia systems have an effect on more than one sense, and can be more effective.
- It can help creativity, it can be varied.
- One can include „games” into the multimedia programs.
- The user feels the success.
- One can use motivating audio feed-back.
- It can be used both in individual and small-group therapy.

In addition for children:

- Also the parent can use it with success.
- Most important is that the child should get interested and his/her interest is kept for long periods of time. This is not an easy task, but multimedia presentations are very effective in this respect too.
- It is like a game: (the child does not find the exercise as penitence, he/she likes it.)

In the following we will point out the special needs of the handicapped people that have to be considered when developing multimedia software.

### **The occurring problems during the software developing and their solutions**

There have been developed multimedia educational and rehabilitation software for special needs in the Colour and Multimedia Laboratory within the confines of Ms Thesis and Young Scientific Works since a decade. Some of the most successful software will be mentioned in this chapter, to emphasize the special needs and the referenced solution.

It is very important to keep on the developer's mind that the *visual impairment and low vision* people have no perfect vision. The visus of perfect vision is 1. A low vision person's visus is between 0.1 and 0.3. Therefore it is important for them to draw thick contour lines of the objects. Sometimes it is necessary to make thicker contour lines during the running of the software (Figure 1). If the low vision person has good colour vision the trainer can build up the development of abilities on this fact. Therefore the software must have a colour choosing function, where the user can change the colour of the object and the background's colour too (Figure 2). It is useful if the user can stop the animations during their running [9, 13].

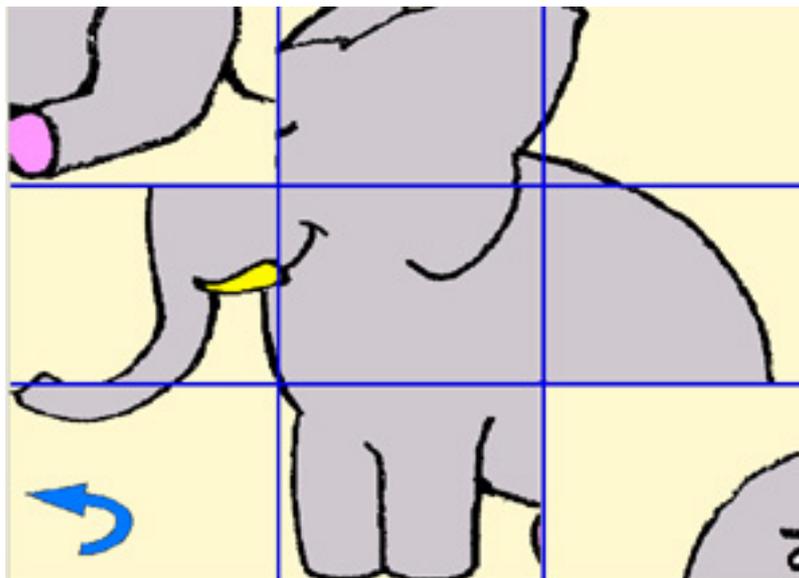


Figure 1: Using thick contour lines

The poor vocabulary is one of the problems of *hearing impaired* people. The main task in the kindergarten for the 3 to 6 years old deaf children is to learn to speak. They have almost no time for other occupations. Even during the school years, between 6 and 16 years of age, the teaching of speaking continues. They have to deal with this subject besides of their normal school subjects. In Hungary deaf children have special schools, where much emphasis is given to teach them to speak. This special task continuous beside of the general educational subjects and the teaching of vocational subjects during the years between 16 and 19 years of age. If we can help them to learn to speak and increase their vocabulary by playing with the computer, it will be a big help for them. It is important to give them the new information very graphically, like a cartoon presentation (Figure 3). It is very amazing that the most hearing impaired children require the sounds too.

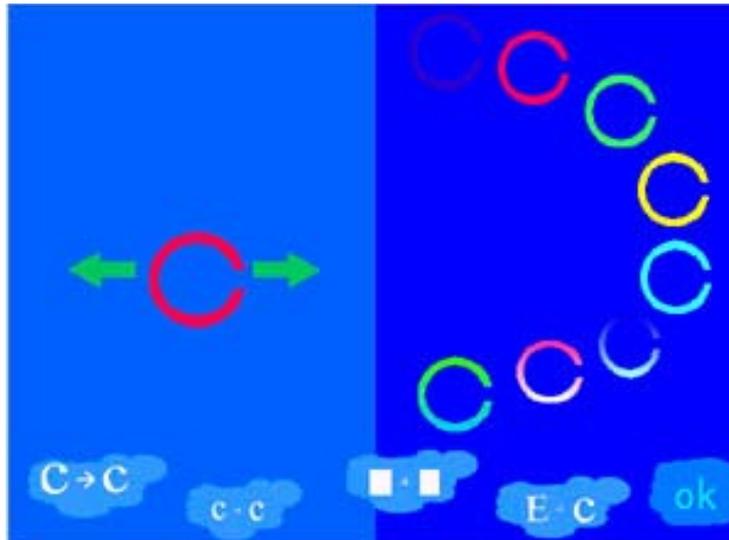


Figure 2 : The optional object's and background's colour



Figure 3: Cartoon like presentation for hearing impaired children

The disabled people who have *loco-motive difficulties* may not be able to use the mouse or the traditional keyboard. He or she can use special input devices, or the software engineer has to design special navigation tools. In this case the disabled user has to operate only one single switch or a big button [10]. Therefore we contrived a blue moving rectangle over the objects on the screen. The speed of the movement is adjustable (Figure 4 and Figure 5).

For the people who have *severe speech and physical impairments* have a number of software to help them in their communication. We developed for them the Bliss Printing, Bliss e-mail sending, Bliss sentences compiler and Bliss sms sender software in Hungary at the suit of Hungarian Bliss Foundation [6]. We used the moving rectangle technique in this software too.

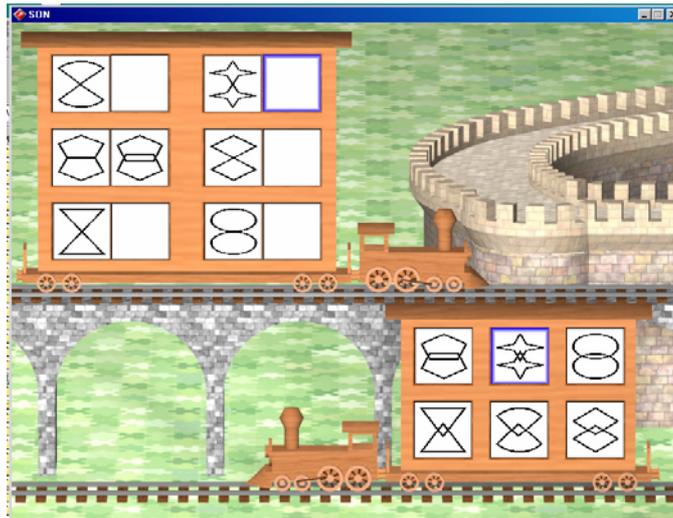


Figure 4: The moving rectangle navigation in the pedagogical test



Figure 5: The moving rectangle navigation in the Memory game

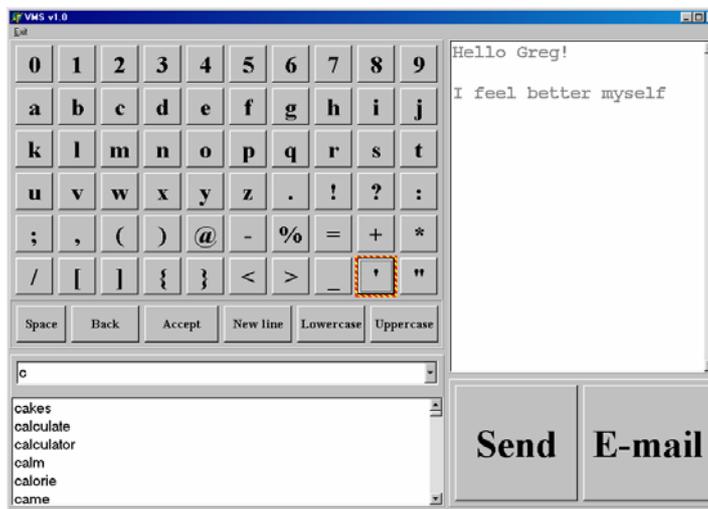


Figure 6: Communication aids for the sick in the intensive care ward

We used the moving rectangle technique in the software what we developed for communication aids for the sick in the intensive care ward too (Figure 6) [12].

We developed three softwares for children who suffer from *dyslexia*. (Dyslexikon, the reader and exercises book of Meixner Ildiko and the Dyslearning software). It is a general principle if we develop a software for people with dyslexia that we have to insert well visible title lines into the text too. This is a good help for these people if they have to read long texts [5].

For developing mental skills of *mentally retarded* children and children who have *learning problems*, the instructions and sentences have to be drafted very simple [5]. The new information has to be written in simple sentences. We have prepared such software in the past, therefore they are not reviewed here (Where, Mystery Stories, Little Mathematic, etc) [8]. (More information can found about them on the <http://www.knt.vein.hu> home page. )

For developing software for colour deficient people it is important to look at the design in greyscale setting too.

After we have collected many experiences in developing multimedia educational software for handicapped children, who have special user needs, we started to develop rehabilitation software for adult stroke patients. The new information and instruction must be very simple for them, like for mentally retarded children. The help in the tasks during running the software is given for them in the necessary amount and at a level the user needs (Figure 7) [11].

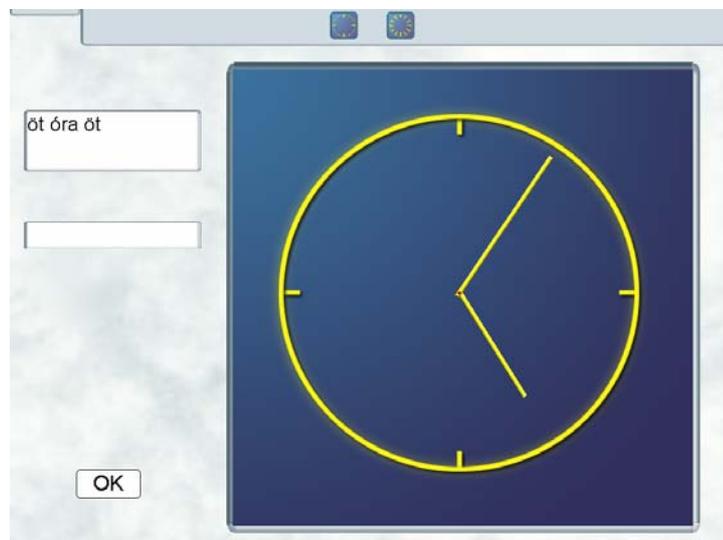


Figure 7: First the quarter- then the 5 Minutes lines are given as a help

### **Experiences and recommendations**

What are the user interface design questions in developing multimedia software for handicapped children? What have software engineers and designers to take into consideration if they develop multimedia educational and rehabilitation software for special needs? These question are summarised in this chapter.

To draw the picture with thick contour lines for *low vision* users! The supervisor has the possibility to install the contour lines of the objects according to the functioning of the user's visus. The colour of the objects and of the background and the speed of the motion have to be variable. The user should be able to stop the animation too.

The *hearing impaired* children have a poor vocabulary. Therefore the new information and the instruction have to be drafted very simply and have to be integrated with cartoon like presentations. The hearing impaired children want the sounds too.

The biggest problem of disabled people, who have *challenges in their motion*, is how to use the input devices. Therefore the task is to find the optimal navigation method for them. If the user does not have a special input device, the navigation is soluble with a moving rectangle of adjustable speed.

Give short sentences and very simple instructions for *mentally handicapped* children!

Give help in the tasks during the running of the software for *stroke patients* in the necessary amount and at a degree the user needs!

The best advice would be that the software engineers should have possibility to test their new software for every type of disabilities. But there are too many different handicaps that should be considered. It is not a practical advice, unless we want to make software for the most handicap people.

It is apparent from the aforementioned chapters that it is impossible to design such multimedia software that can be used by every type of handicaps. The only solution is to design for a given type of handicap. But in this case not only the needs but the physical and mental abilities of the users have to take into consideration!

## **Summary**

This article presented our more than one decade experience. During this long period there we have developed more than 30 multimedia educational and rehabilitation software for special needs in the Colour and Multimedia Laboratory within the confines of MS Thesis and Young Scientific Works. The most successful software will be presented at the conference. More information of the software is on the <http://www.knt.vein.hu> home page.

## **Acknowledgements**

The authors would like to acknowledge the subsidy of the Széchenyi program of the Hungarian Government. The research and the software developed for Stroke patients has been supported by the NKFP 2/052/2001 Project. We would also like to acknowledge the help of Dr. Ilona Pataky neurophysiologist who gave useful advises. We would also like to acknowledge the support of the "Give Chance of the Future" Project of the International Children's Safety Service and of the Hungarian Ministry of Informatics and Communication.

We thank the laborious work of the more than 70 university students, who designed the software. Their names are written on the Laboratory home page (under the thesis and Works of Scientific Youth Club).

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