

ON MICE AND HADICAPPED CHILDREN

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Abstract

When beginning to work with computer everyone start with learning how to operate with the mouse. For the normal children this period is quite easy and always takes very short time, but the children with any physical problems are required different and step-by-step practical exercises in order to learn the common hand activities with the mouse. That process takes quite a long times and is not always with a successful end. The paper shows the problems related with teaching the children with cerebral palsy how to work with a mouse. It will be present methodical program based of special development software products that aim to teach the children of the common mouse activities are also shown. The results of the programs, realized at the Center for treatment and rehabilitation of cerebral palsied children (Sofia, Bulgaria) will be also presented.

Keywords: Handicapped children, mouse control, Comenius Logo

1. Introduction

With the ability to combine in whole text, sound, graphics and animation, the computer has become a wonderful attractive instrument for the children nowadays. The kid could spend hours and hours taken in what's happening on the screen. In order to take part in the process and not just monitoring it, the child should possess definite skills for navigating the computer system.

The work in a graphic interface has become a standard in computer systems with the entering of Win 95 as an operating system with the IBM compatible computers. The main object, used to navigate is the graphic pointer (usually looking like an arrow) on the screen. This is the reason for being so important to improve skills for navigating the pointer is the first right step in computer education. This process depends on three factors:

- individual skills of the child;
- what peripherals is used to navigate it;
- what software decision has been made for learning it.

2. Individuals

When we consider the individual creatures of the children, we should pay attention to the fact that physically healthy children have mostly psychological difficulties with meeting something new, not known and challenging /learning to navigate the mouse pointer/. When considering handicapped children this is mainly because of the existing problems in separate physical process, caused by their illness and physical disability. These creatures of the handicapped children lead to clear division of the education to separate periods, including learning separate sub-activities in working with the mouse. When providing these periods, we should consider the next points:

1. In what way is the rough motorics spoiled, caused by the illness.
2. In what way are the physical functions spoiled, caused by the illness.
3. In what way is the fine motorics spoiled, caused by the illness.
4. The impossibility of one-time learning of two activities, caused by the spoiling of the rough and fine motorics.
5. The long time period for learning every separate movement with the mouse must become a mechanically learned movement, and as a result the child would be free to think about the problem solving, but not about the action.

3. The Peripherals

There are two different decisions possible:

- using a standard two-buttoned mouse;
- using some alternatives

With alternatives we mean working with a joystick, trackball, a sensor screen and their variations, specially developed instruments similar to a normal mouse. A different position of the elbow, wrist and hand is used for working with these instruments. Somehow they easy a definite group of activities for navigating the mouse pointer on the screen.

In our two years working with children, having cerebral palsy and other neurological illnesses in the *Special hospital for residential treatment of prolonged therapy and rehabilitation of children with cerebral palsy "Santa Sofia"*, we came upon the conclusion that in 70% of the cases the use of standard peripherals is better because of the next reasons:

- Handicapped children are given the possibility to work with the same instruments as the healthy children do and thus they don't feel different.
- The standard two-buttoned mouse gives different possibilities for working, such as combining of the activated button and the preferred for work right hand. In the cases when the right hand is not available at all, the child could work with a mouse with the right button active, instead of the left one. The same possibility is given in the cases of spastic palsy, because of the impossibility of the children to place its right hand, caused by the spoiled fine motorics of the child. This adjusting of the buttons is easy and constant in the operating system.
- The standard two-buttoned mouse was preferred before the Track ball, because the Handicapped children use the mouse as a base and moving it with the hand they control the

different activities. It is very essential for them the constant positioning of the hand on the table, concerning the wrist to the elbow, keeping the standards for the child position until working – 90 grad. among the body and the leg bone, and 45 grad. among the body and the shoulder bone.

- The standard two-buttoned mouse was also preferred before the Joystick, because it causes difficulties concerning the space orientation. In most of the cases the Handicapped children have spoiled body scheme and are not able to adjust their thinking to a three-sized situation, and the Joystick causes difficulties in the coordination, with the position of the hand and the position of the mouse pointer.
- Because of the spoiled fine and rough motorics of the Handicapped children, they can not take the right position of the body and the hand when working with a mouse, which needs the wrist to the shoulder to be straight. Considering this, the standard mouse is a flexible decision allowing the child to work inspite of its difficulties.

Because of the existing life conditions in the country, we considered for not reasonable the using in the process of education of expensive for the families, peripherals. This could lead to necessity of pre-education of the child for a new position of the hand and actions with it.

In the process of education a few problems have formed out, concerning the learning of work with a two-buttoned mouse:

1. Most of the children can't abstract from the work with a mouse upon the desk. In some of them, the child thinks that the mouse base is a limited all the time the child pays attention on the fact but not on the action.
2. Because of the fact that Handicapped children have a visual thinking, most of them can not connect the mouse as a peripheral and the pointer on the screen. This leads to difficulties when synchronizing the mouse movement with that of the pointer on the screen.
3. Because of the illness – child cerebral palsy and its causes upon the fine and rough motorics, the children meet difficulties in holding the mouse pointer in a constant position.
4. The biggest and most often difficulties are those in the coordination among the coincident positioning, button pressing, button pressed holding and dragging with the mouse.

4. Software solution

We've developed a group of games (in Comenius Logo), allowing a complex approach of the main activities with the mouse:

- free movement with the mouse upon the desk base and positioning of the pointer on an object on the screen;
- one click with the left or right button;
- dragging with a pressed button.

The main purpose is the child to feel the game situation, which asks it for doing any activity with the mouse. The game problem solving motivates the child for being precise in its

movements. In the same time the games contain educational meaning, which is concerned with the specifics of these children (1).

The learning of the main movements with the mouse is put in the base of the separate games, in different levels. Thus, for example, in one of the first games **Silhouettes**, the child manages the shadow of an object, which should be placed over the silhouette of the same object. We use here a great sized graphic object as a pointer on a contrast gray background and it's easy to be followed by the child. In every turn of the game the pointer takes a different form of a known object, which is a motivation for long time working. This leads to better learning of the movement in the base of the game. In the last level the child meets for the first time with the standard form of the mouse pointer, just with a bigger size but it could be regulated to reach the original size.

Lead by the mentioned problems in working with the mouse we created the next software solutions for seizing the main movements (3).

SILHOUETTES

In this game the pointer takes the form of an object which should be placed over another. This could be done with free movement of the mouse on the desk base. This game is introducing and it plays a great role especially for children not having worked with computers.

For a healthy child it could hardly cause any difficulties with assimilating the movement. It will need about 2 or 3 days, so it could without any problems to move the mouse in any part of the screen. The situation is not the same with the children with cerebral palsy. There's a special problem with an athetoid form of cerebral palsy. They could hardly coordinate their movements, which are random and chaotic. Such are 20-30% of the cases. The same is with the children with ataxic form of cerebral palsy – they hardly reach to stopping an action (2). This doesn't let them to hold the mouse statically on the screen and smoothly moving it to other point. The problem with the spastic form of cerebral palsy is somehow different. These children have incorrect holding of the mouse because of the specific conditions of the hand position and this holding could not be corrected. They usually use the right button.



Figure 1: Input screen

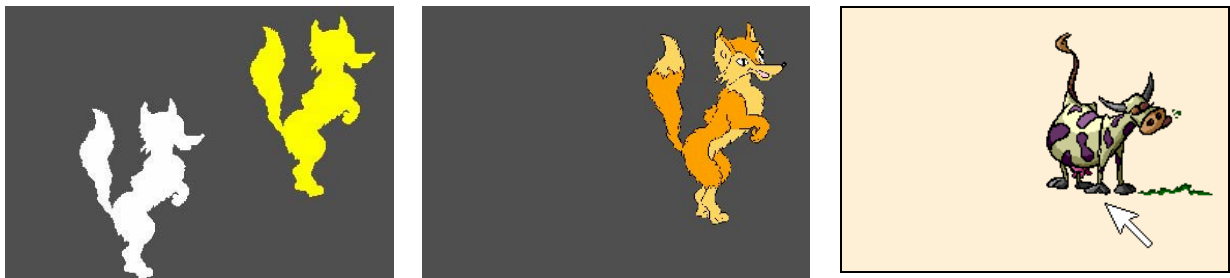


Figure 2: Screen dumps from Level 1 and 3 of the game

These are the reasons for seizing the mouse movements with those children should be trained separately. In this way children become surer in their movements, the mouse hold becomes more stable and this leads to easier learning of the mouse movements.

SHADOWS

In this game the accent is upon the seizing of two main movements with the mouse – clicking with the left button and dragging an object with the left button pressed.

Here are situated several educational problems. This game helps the developing of an abstract thinking in children, their curiosity and analyzing, synthesizing and comparing skills. In this case they are connected with the comparing of two main multitudes of objects – colorful pictures and shadows. The first multitude contains rich detailed objects, colors and forms, and the second contains simple, common images, keeping only the main forms of the objects.



Figure 3: Input screen

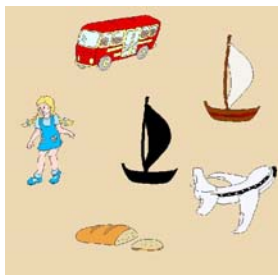
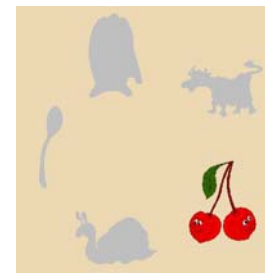


Figure 4: Screen dumps from Level 1



Figure 5: Screen dumps from Level 2



It is not a coincidence that the picture base is composed of chosen similar to children objects, e.g. it is worked in the so called Area of Actual Cultivation of the children, and is supposed they could helpless with the given problem. In the case we don't aim learning new objects but seizing and improving of the new skills. This becomes possible upon the base of similar to children objects with which the children have a direct contact.

SOUNDS

In this game movements, as left-button one click and dragging on the screen with the left button pressed, are seized and improved.

Despite all these technical skills, the game is also important for children with cerebral palsy, having language and spoken problems and problem in the phonemic gnosis. This often leads to misunderstandings and difficulties in communication. The game has two main multitudes - of the pictures and of the sounds which are pictures' names. Thus the child could hear the right pronunciation of the



Figure 6: Input screen

word and connect it with the right image - an existing image similar to children. The game develops in children the ability to differ sounds that have been heard. Considering the fact that the mechanical memory is stronger in most of these children, the game assists the right accepting of an adequate number of words, connected with images that the children could directly contact with.

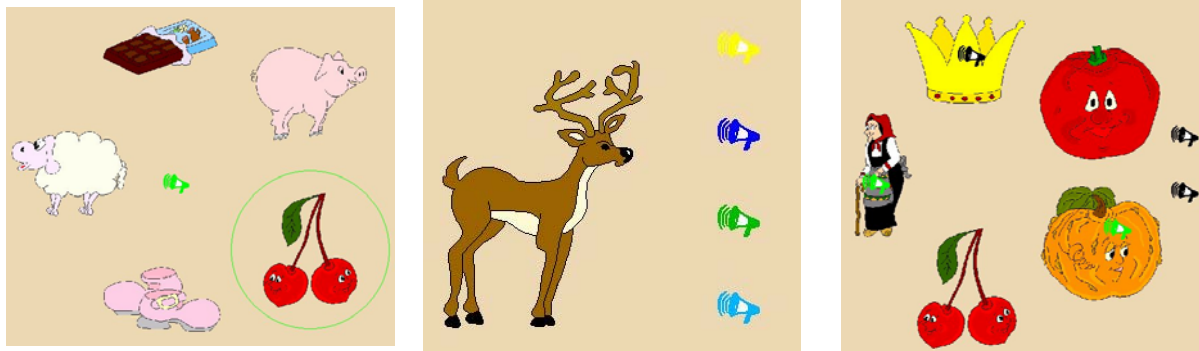


Figure 7: Screen dumps from the Levels

WORDS

The game helps the process of seizing and training of movements as left-button one click and dragging an object on the screen with the left button pressed. Here are used two multitudes for work - one of the colorful images and other of the words, so the game is for children who already can read and write. Despite technical skills for working with the mouse, seized in the game, it also helps the intellectual development of children. The connection word - picture develops their logic. With the **Shadows** and **Sounds** games the forms and the names of the similar images are already trained, and the visual and hearing ability of the child has been formed. Here the names of those objects already have a written form and that's why the child should recognize the letters, read and write. In any other cases it could not handle with the problems in the different game levels.



Figure 8: Input screen

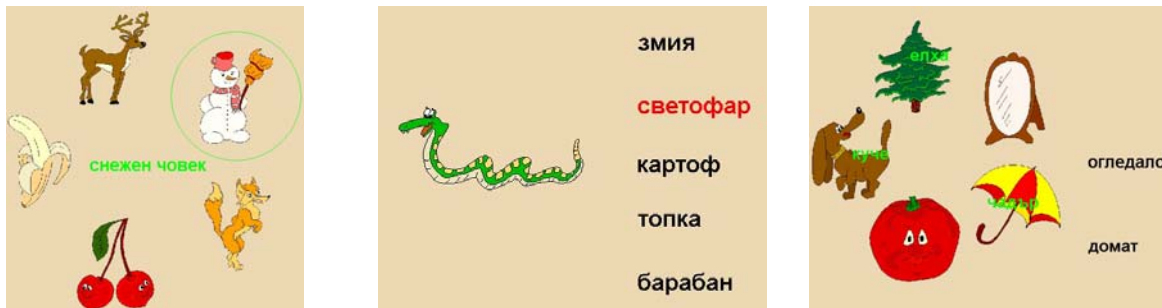


Figure 9: Screen dumps from the Levels

5. Educational program

Considering all the mentioned software solutions an educational program was developed, including continuity for the using of each separate problem, psychological and educational aspects of using the program.

We present the program in shortly in table 1:

Table 1: Program for training

Game Name	Age Group	Period of Education	Educational Aspect	Psychological Aspect
Silhouettes	4 years old	Until seizing the free movement of the mouse, but not more than 3 months	Free movement with the mouse, pictures images recognizing	Comparing an object and a shadow, developing the attention line in each aspect
Shadows	4 years old	1. Until seizing the one click with a button 2. Until seizing the dragging with a button pressed, but not more than 6 months	Possibility for doing a simple logical operation	Developing an abstract logical thinking, analysis and synthesis
Sounds	4,5 years	1. Until seizing the one click with a button 2. Until seizing the dragging with a button pressed, but not more than 6 months	Possibility for doing a simple logical operation	Developing an abstract logical thinking, analysis and synthesis, development of the phonemic gnosis
Words	Over 5 years	1. Until seizing the one click with a button 2. Until seizing the dragging with a button pressed, but not more than 6 months	Possibility for doing a logical operation	Developing an abstract logical thinking, analysis and synthesis, development of the phonemic gnosis, learning the graphic image of the word

6. Results

The educational program for seizing the main mouse movements is applied in a year period and its using showed a great psychological and educational effect. The next results came out:

- Seizing the mouse working, the reached level depends on the individual creatures of the children.
- The space orientation was improved with the children with cerebral palsy.
- Improving the coordination, the space and constructive praxis with children with dis-praxis.
- Improving in all the pointers of psychological profile of every separate child, due to the educational effect of the program.

The presented software solutions for seizing the main mouse movements and the results after them proved the usefulness of the program and allow its applying to other groups of children with disabilities, with problems similar to these in the computer education. The educational program for working with the mouse is suitable for children with normal kinesiological status and for children with cerebral palsy, MBD, epilepsy, praxis disabilities, combined disabilities connected with the high korone functions.

7. Reference

1. Ilieva V., Ivanov I. (1999) *Graphics* – series of books “The Computer in Primary School”, Regalia 6, Sofia.
2. Valente, J. A. (1983) *Creating a computer-based learning environment for physically handicapped children*, USA
3. Ivanov I., Zafirova T., Jordanova N. (2001) *Special games for handicap children to get control on the mouse*, EUROLOGO 2001, Linz