A Touching Interface for Young Children

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ABSTRACT
In this paper a computer interface utilizing a touch screen for a two year old child is presented. The results show that the child is able to operate some simple programs using the touch screen. This demonstrates that the child has the ability to comprehend the fact that their action is able to manipulate the state of the program.

Keywords
touch screen, computer interface, children, fish

1 INTRODUCTION

The advent of the computer has enriched the lives of many. They have applications at work and in our daily lives. Programs such as e-mail and instant messaging help us communicate with others, while QuickTax help us file our tax returns. We have reached a point in the development of the computer where it is difficult to think of an area where the computer does not enrich our experience.

However, as computers become more entrenched in our lives one group is constantly being neglected. Children between one and three years of age have not been addressed. This group is both physically and cognitively different than the typical computer user, which suggest that the current mouse and keyboard interfaces do not suite the needs of this group.

Some research has been done by Strommem[4] on interfaces for three year old children. His results show that three year olds are capable of using Nintendo controllers. The children were able to use the direction arrows to control an animated bird on the screen. The youngest of the three year olds had some difficulty performing this task. This suggests that initial attempts at developing an interface should focus on something that will not be cognitively demanding for children.

This paper will focus on using a touch screen as an interface for a two year old child. Due to time and resource limitation the system will only be tested with a single subject. The touch screen was chosen as an interface because it provides a direct correspondence between an object on a screen to what the child is manipulating.

2 SYSTEM DISCRIPTION

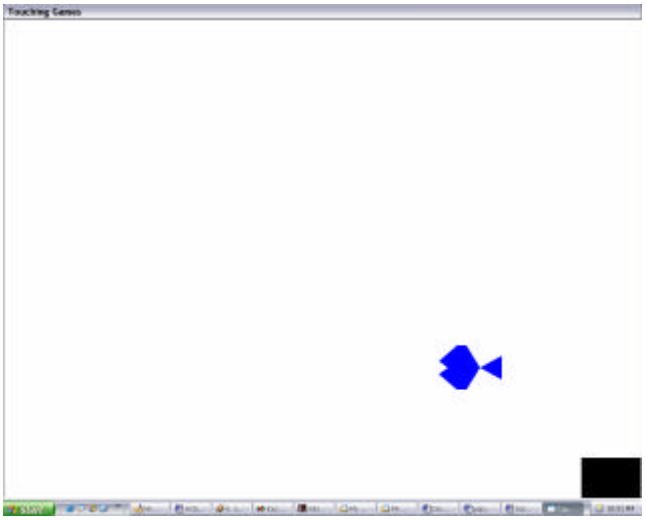
The System has two subprograms for the subject to interact with. The first subprogram was a simple paint program and the second was a virtual fish.

The paint program consists of a main drawing window, and six sub areas. The 4 large areas on the left allows the subject to change the drawing color and erase the picture. The thin strip to the left of the 4 large areas gives the user feedback to the current drawing color. The area to the top right hand corner allows the user to switch to the next subprogram.

The user is expected to draw with a finger in the main drawing area and change color when he feels like it.

The second program is a virtual fish. A fish follows the mouse cursor on the screen. The mouse cursor appears at the last location the subject has touched. This program exists for two reasons. First, the fish swims in the same space as the paint program, so it provides a second mode of

operation for the window. Second, it tests if the user is able to give commands.



Hardware description
The hardware used was:

1) K6-2 400Mhz laptop, running Microsoft Windows 98
2) Keytec Magic Touch 17" touch screen using the serial port to connect to the laptop
3) IBM G70 17" monitor

This hardware was chosen because it was available.

Software description
The software was written in Visual C++. The Microsoft foundation class (MFC) was used to handle many of the overhead related to writing a Windows based program. The touch screen behaved like a mouse, so no special drivers were needed. The operation of the software may seem unusual when used with a mouse and keyboard. The software was designed to be used with a touch screen pretending to be a mouse. This fact suggests that the touch screen hardware should interface with the computer differently if the computer is used by older users and younger users. But since this paper is not concerned with subjects older than three, it was not a concern.

3 TESTING

The recommended testing method[1], for a two year old subject is, to let the subject explore the interface with as little interference as possible. The subject was shown how each subprogram worked and how to change between each program. The physical setup of the system had the monitor placed on the floor and the subject was placed in front of the monitor. The experimenter carefully observed the subjects interactions with the computer at all times. An improvement on this system is to have several people act as observers to eliminate behavioral bias to an observer. This was not possible due to time and resource limitations. A two year old child should not be left unattended in front of a computer.

Unexpected behavior
When people think of using a touch screen they expect a single finger to interface with the screen. The subject had no such bias. Some unexpected behaviors include:

1) Kissed the virtual fish
2) Used the head as a drawing mechanism
3) Used feet as a drawing mechanism
4) Used the Velcro straps attaching the touch screen to the monitor as a drawing mechanism
5) Grasped the touch screen for stability
6) Climbed the computer monitor
7) Attributed eating behavior to the fish

Observations
Despite the multitudes of unexpected ways the subject interacted with the computer, the subject did demonstrate understanding of using the computer interface. This conclusion was arrived at by observing the behavior of the subject. Many of the results were arrived at based on communication from the subject to the experimenter.

Observed behavior with the paint program:

1) Drew a circle on the screen and said the word circle.
2) Selected the color red then drew a circle on the screen, and said red circle.
3) Demonstrated a preference for a blue circles when experimenter changed to color to red, by changing the color back to blue.
4) Demonstrated the ability to erase the screen by selecting the area needed to erase the screen.

Observed behavior with the virtual fish:

1) Guided the fish, by moving his fingers slowly across the screen and looking to see if the fish was following.
2) Identified the animated object as fish by said the word fish.

Other behavior:

1) Verbally requested the fish program when in paint mode.
2) Requested the experimenter change from paint mode to fish mode. The experimenter did witness an attempt from the subject to try and switch modes. This attempt was unsuccessful. Further desire to switch mode were verbalized
3) Requested to play with computer to parent on several occasion after first use.

The direct actions of the subject clearly show a degree of comprehension of the system. The subject has demonstrated much cognitive ability in using the system.

The fact that the subject is able to draw a circle and control the location of the fish shows that subject is able to understand how he is manipulating the system. The subject is able control the system to achieve a desired outcome. The ability to select different color suggests that the subject understands that the state of the system can be changed, but more fundamentally can understand the fact that the system has state and how the subject can change this state.

4 SOFTWARE EFFECTIVENESS

The paint program was not too effective. This was due to the technical problems caused by parallax and the fact that the touch screen only supported single point interactions. More fundamentally, the subject lack sufficient ability to draw what he was thinking. Both these problems led to frustration on the part of the subject, because the system fail to operate as the subject expected. However if a multitouch touch screen was employed the program would have likely been more successful.

The fish program was very successful. This was demonstrated by request from the subjected to see the fish on several occasions after the initial exposure to the fish as well as a preference for the fish program over the paint program. The subject did enjoy the use of both program.

The subject enjoyed the ability to control the computer. This could be attributed to past observations of others using a computer and the subjects desire to copy such action. The actions, by the subject, which caused a response by the computer, when the program was not running, amused the subject.

5 TECHNICAL PROBLEMS

Because of the small size of the subject, the subject needed to grasp nearby objects and occasionally the touch screen itself for stability. This suggests a handle should be attached to the monitor to provide an area for the subject to grasp.

The touch screen was elevated several centimeters above the touch screen. The fact that the subject operated and viewed the touch screen at many angles and distances caused a correspondence problem between the area where the subject wanted to affect and the area on the screen that was affected. This led to degree of frustration on the part of the subject.

The subject on several occasion grasped onto the touch screen. The mouse cursor would not operate as the subject expected when this occurred, because of the single touch nature of the screen. This caused the subject to be frustrated.

6 CONCLUSION AND FUTURE DIRECTION

The success of the virtual fish suggests that a virtual pet application would a useful application to explore in the future in understanding more ways in which a 2 year old child can interact with computer.

The subject demonstrated clear ability to use the paint program and virtual fish program. This shows that a two year old has the cognitive understanding to operate, at the very least, simple applications on the computer. The ability with paint program also suggests that interface involving buttons with feedback may also be an effective interface.

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REFERENCES

1. Hanna, Risden, and Alexander. Guidelines for usability testing with children. *interactions...* (September + October 1997), 9-13
2. Stern. *Interpersonal world of an infant.* Basic inc., Publishers: New York, 1985
3. Strommen, E. (1992). Formative Studies in the Development of a New computer Pointing Device for Young Children. *Educational Technology* 32(4), 43-51
4. Strommen E. et al. (1992). This button makes you go up: three-year-olds and the Nintendo controller. *Applied Ergonomics* 23(6), 409-413
5. Strommen, E. (1993). Is It easier to Hop or Walk? Development Issues in Interface Design. *Human-computer Interaction* 9(4), 337-52