PENS BEHAVING BADLY – USABILITY OF PENS AND GRAPHICS TABLETS FOR TEXT ENTRY WITH CHILDREN

Janet C Read, Stuart MacFarlane, Chris Casey
Department of Computing
University of Central Lancashire
Preston. UK
Tel: 01772-893276
E-Mail: {JCRead, SJMacFarlane, CCasey}@uclan.ac.uk

ABSTRACT

This paper describes some of the hardware difficulties that are observed when children use graphics tablets and pens to enter text into computers. The occurrence of, and the consequences of, position errors with stylus pens are discussed; and two explanations are offered. Interface design strategies that can help to reduce these errors and minimize their effects are described.

Keywords

Pen computing, Errors, Recognition technology, Interface design, Children, Handwriting recognition.

1. INTRODUCTION

This paper describes one problem area that has been identified during an extensive study into the usability of handwriting recognition technology as a possible text entry interface for children aged between 7 and 10. Previous work by the authors has demonstrated that there is scope for this technology, but the software and hardware is error-prone, and this presents usability challenges [1].

2. POSITION PROBLEMS WITH PENS AND TABLETS

Children aged between 7 and 10 have been observed on a number of occasions using a Wacom® graphics tablet with a computer running Pen Office® software. Some of these observations have been made in the classroom, others in controlled laboratory sessions. The children have been writing their own text on the tablet. This writing is displayed on the computer screen before it is 'recognized' by the software and turned into digital text. This digital text is then displayed on the screen in a regular font. The children make a range of user errors during the writing process and the software subsequently makes recognition errors. Some of the user errors relate to the positioning of the pen and are henceforth described as 'position errors'.

2.1 OBSERVATIONS

As the child begins to write, the first position error that is seen is when the pen position on the tablet is not mapped to a place within the writing area of the display screen. This can also occurs during writing when the script written at the tablet runs off the screen page. The consequences of these errors vary in severity. In the worst cases, the pen becomes a selection tool and an accidental double tap can open up menus and cause irreversible actions. In other cases, the writing is not captured and it has to be repeated.

The second type of position problem occurs when the pen lingers below writing that has already been recognized. In this instance, the pen acts as a pointer and it moves the screen cursor to the point above that at which it lingered. When the pen is used again to write, the next piece of text will be positioned in the middle of the work already on the screen.

2.2. EXPLANATIONS FOR THE ERRORS

There are essentially two physical 'causes' for the errors outlined in 2.1. The first is the separation of the screen display and the writing space. The second is the multi-functionality of the pen device.

Where pen input is used with standard desktop PCs, the screen display and the graphics tablet are separated. Children can only be looking at one of these two devices, and typically when they start to write, they look at the tablet. It is only after the first letters have been formed, that the child looks to the screen to establish whether or not they have 'got on' the writing space.

In a similar way, if the child is busy writing, then he may not realize that he has gone beyond the writing space and has in fact 'fallen off'. Observations have indicated that once children have fallen off a couple of times, they seem to realize what is happening and start to watch the words on the screen, as well as, or instead of, looking at the tablet. For younger children, this represents a considerable challenge, as they seem to need to watch the pen when writing.

The effect of the separation of the spaces is compounded by fact that the pen is multi-functional. It operates as a writing device (stylus) and as a pointing device, and it automatically changes mode when it leaves the writing area of the screen. This behaviour results in mode errors that are exacerbated by the inadequate indication to the user of the current mode. As the mode changes, the screen cursor changes but typically the child is not looking at the screen at the moment of alteration. He or she is sometimes unaware that a change has happened, writing continues, and the child is left confused by the resulting text or actions. This multi-functionality is also the cause of the problems with the recognized text. The child moves the pen to a place below the text on the page, intending to write, and the pen becomes a pointing device and inserts a cursor in the text.

3. SOLUTIONS

The challenge for the authors was to produce design solutions for a desktop PC with a graphics tablet and pen. Any solutions should reduce the instances of errors, aid the recovery from errors, and minimize the effect of errors. It is not possible to eliminate all errors and it is the case that users are able to learn from errors and can modify their behaviour given the right clues [2].

The problem of starting at the right place can be partially resolved by the careful mapping of the tablet and the screen display. The tablet has a writing area marked out, and this can be aligned to the screen display. Some children may find that they position their pen more accurately if a piece of paper, representing the writing space, is placed on the writing tablet. This is easy to implement as the tablet has a semi-transparent flap below which paper can be placed.

Ensuring that there are no menus in the top left of the screen can minimize the effect of errors. Where menus and command buttons are visible on the screen they should be kept in one area and can be 'guarded' from accidental activation. These menus and commands will be safer if they are placed at the bottom of the screen rather than on the right hand side (where the pen may run on).

'Guards' can be used to assist children to stay on the writing area. Children have been seen looking at either the tablet or the screen, and so guards in both locations would be advised. These guards may be physical or virtual; they may use motor senses, visual senses or auditory senses. The software may beep when an edge is encountered; a physical edge could be attached to the tablet, the placing of paper on the tablet would provide a visual boundary by showing the extent of the writing area. When the pen is 'outside' the writing area, a visual warning sign or an auditory beep may inform the user.

The problem of the pen lingering and becoming an edit cursor is only an issue when the text has become digital. This sort of text will appear during recognition and it will also typically be the text that the child is editing. 'Lazy recognition' by which the text is recognized after the writer has finished will help to minimize this particular problem but this results in more errors within the recognized text as the child is unable to adapt his writing to suit the recognizer due to there being no feedback until the end of the recognition process. In addition, if the child is writing a long piece of text, the page and the buffers will both become too full!

The lingering of the pen is not all that easy to solve. One difficulty for the child is that the pen changes on its own; it is a useful editing tool, but it may be that for young children, the pointing facility should be deliberately turned on and off by the child. A second strategy is to advise the child that the cursor has changed – possibly using an auditory or a haptic clue.

4. CONCLUSION

This paper has examined two types of position problems for pen-based systems. Robust interface design, including uncluttered interfaces, will reduce the negative effects of poor pen positioning. The problems associated with the pen being multi-functional are more difficult to resolve. The authors have observed children typing at the QWERTY keyboard and on more than one occasion, children have been seen to be confused by the appearance of a second cursor on the screen, that being the one relating to the mouse position. These 'confounding cursors' present difficulties for children as they struggle to understand how they can be controlled.

Auditory warnings may assist the user, but will fail to improve the mental model that the child has. Observations of children correcting errors seem to indicate that the children mix pen-paper and keyboard-screen mental models when using this technology. This double vision may help in improving the mental model that the children have of confounding cursors. Further work will concentrate on assisting the child in the formation of a useful model of the interface.

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