Evaluation of Digital Drawing Devices with Primary School Children - a Pilot Study

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**Abstract:**

Up to now empirical studies of digital drawing technologies for children have focused on the specific aspects of software. In contrast to that, the factors of the “hardware” and their effects on pictorial processes have hardly been investigated. This paper reports a pilot study on three different drawing devices in some English primary schools. The focus of the study is on children’s drawing process and an insight into the problems children encounter with the devices. The findings suggest some implications for the design of digital drawing technology for children.

1 **Introduction**

Drawing is a common popular activity among young children, which is of developmental importance and of esthetical value in childhood [11]. The impact of drawing technology on children’s esthetical process and creations has been the focus of some recent studies [8]. This paper presents the extended study on 9 to 10 year-old school children and digital drawing technologies.

1.1 **Children and drawing technologies**

Drawing technologies were originally designed for professionals. Some common types of drawing devices are graphics tablets, slate and tablet PCs. They allow the user to draw on a flat digital tablet surface using a digital pen/stylus; the drawing is either displayed on a computer screen or on the tablet itself. More recently, there are an increasing number of commercial products that have the capacity for drawing: from portable devices of _Apple®_ such as _iPhone _and _iPad _to the situated home furnishing of _Microsoft®_ _Surface_. There is a number of commercial drawing software products specifically designed for children; however few hardware technologies are aimed at young users. In schools, children do digital drawings mainly on desktop PCs with mouse. Child-centred digital drawing technologies are in their infancy with most existing as research prototypes, not broadly available, such as _KidPad_ [10], _I/O Brush_ [9], _Jabberstamp_ [8] and more recently, _TellTable_ [2].

1.2 **Technology impact**

The previous studies [6, 7] show the impact of drawing software has a significant modification in children’s esthetical behaviour: features like “save”, “undo”, “repeat” or “delete” lead to process-oriented, non-linear and experimental behaviours. Child’s interests in
drawing and the medium (software) have an effect on whether these aspects are visible in the drawings. The two factors might interact, alternate and interfere with each other without a noticeable break. The aspects of hardware as a part of the digital medium only have been investigated from the ergonomic point of view so far [3]. As shown in the early study, the esthetical-pictorial behaviour could depend on hardware elements in a fundamental way [3]. As the actual handling of the physical device and reading from the display manifests directly from the drawing (e.g. the impetus or impact of the brush). In this study, among the three chosen drawing devices, slate and tablet PCs offer direct manipulation and natural interaction, this would set them apart for the graphic tablet.

2 The study

The aim of the study was to specify the pictorial and esthetical process with children directly involved. We visited three local primary schools and worked with 54 children aged between 9 and 10 (30 boys and 24 girls). The methodology approach of this study is child-centred, coordinated with the esthetical, cognitive and motor skills of the children [5]. Initially, children were asked to draw anything of their choice with the randomly allocated drawing device. To understand the problems they encountered and the positive and negative experiences they had, we structured the study as such: during the drawing, we carried out observation and active intervention [5], and straight after that, a questionnaire and a recorded focus group [1] was carried out. Data collected include children’s drawings, notes, photographs and enquiry data collected during and after the children’s drawing process.

2.1 The drawing devices

Three different drawing devices (Fig 1.) were used by the children for their art creations: Device A was A6 size Wacom® graphics tablet with DuoSwitch erasing Grip Pen stylus connected to standard desktop PCs; users draw on the flat tablet surface using the stylus with the drawing displayed on the computer screen. Different from Device A, Device B has the tablet and the display screen in one, they are RM® slate PCs with a stylus and touch-screen HP® tablet PCs with a stylus; the two models are very similar in terms of physical size and their usage, however the last one has a touch sensitive screen, which allows children to draw with any stylus-like object. 26 children used Device A and 28 used Device B in this study.

![Figure 1. Devices A and B: Graphic Tablet (left), Slate PC (middle) and Tablet PC (right).](image)

3 Results and discussions

We found out that the majority of the children (53 children) only knew the mouse as an input device, most of the them (39 children) said they had drawn on computer before with Microsoft Paint. Some problems were observed during the drawing activity, however, in the discussion, the problems were played down by the children, they believed that the difficulties of using the devices would be overcomed when they get familiar with the devices. Children were generally very optimistic with the devices and pointed out that the digital devices could do a lot of things.
3.1 Observed ‘problems’

Input devices
We observed that children had some difficulties of handling the input devices (e.g. Fig 2.). For example, the stylus was difficult to grasp as it was often slippery on the tablet surface; similarly there were difficulties with the mouse, when fine movement skills were required for the drawing. However these seemed not ‘problems’ to the children. 

One boy often embraced the stylus with both of his hands. When asked whether he had a problem, he negated confidently: the tablet was easy to use and embracing from time to time only gave him more stability.

Another boy took both hands to hold the mouse while drawing. As the observer asked him whether he had had a problem with the digital pen, the boy answered that he did not know why he had used the mouse and that it was probably more familiar.

Figure 2. Handling the Stylus and the Mouse.

A few children were seen handling multiple input devices simultaneously: they used the digital pencil to draw and the mouse to choose functions (Fig. 3). The reason could be that children have difficulties of double-clicking a digital pen while drawing; or it could be that children did not notice the button on the digital pen and/or not aware of its function.

Display
Often the children brought themselves very close to the slate/tablet PCs (Fig. 4). We assume that the tablet display was a problem: as the screen switched to energy saving automatically as it ran on battery; and it also reflected light in the room, which made it even harder to see.

3.2 Reported problems

In the questionnaire, 35% the children (19 children, 10 with Device A and 9 with Device B) reported problems. The following is a list of reported problems:

Input devices
As we have observed, children have problems with handling the input devices. In the questionnaire, this problem was mentioned by 10 children (6 with Device A and 4 with Device B). They reported that the stylus were hard to handle and draw with.

Display
The two major causes of the display problems are low brightness and poor calibration. In the questionnaire, 5 children (2 used Device A and 3 used Device B) reported that the drawing on the display was difficult to see. In the focus group the problem of the tablet calibration was mentioned a few times while it was only reported by one child in the questionnaire.

Other reported problems
Another commonly reported problem is the mismatch between the system response and user expectations, that is, when the computer did not work the way the child expected, e.g. a girl was complaining that the old painting came up again and again; another boy was not happy ‘it stopped drawing halfway through.’ and etc.

3.3 Other observations and reports

It was observed that some pictorial processes seemed to be influenced by the kind of input device and a number of children left stylus aside and used solely the mouse to draw.
Children’s collaboration was seen during all sessions: from time to time they looked at each other’s work and discussed. For the multi-touch tablet PC, some children liked the fact that they could use two digital pens simultaneously on the same screen. Despite all the problems, a number of children said that they preferred a tablet rather than paper, as they could pick it up and mix colours easily; it was realistic and they enjoyed the novel and fun experience.

4 Conclusion

With the participation of children in the evaluation, the holistic “consideration of authentic interests of users” has been claimed in informatics for a long time, as realized [4]. This pilot study of the digital drawing devices leads to some interesting findings on the common problems children encountered with the technologies, their preferences, positive and negative experiences. We hope these findings can potentially contribute to the future design and evaluation of the children’s digital drawing devices.

References:


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