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Paint On The Finger Or Paint On The Screen: A Comparative Study

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Abstract

The aim of the study was to explore young children's touch-based interaction with Tablets. In particular it aimed to examine how finger painting might change in this digital context versus the physical context, and whether it engenders different kinds of touch movements or changes the nature of the painting process. Children aged between 27 and 37 months from a London nursery school took part. Each child freely explored 3 'painting' applications on a Tablet computer, and made two pictures by finger painting on paper. Data collection involved the use of video recordings from 3 different perspectives (video of the tablet screen, micro cameras embedded in the tablet frame of the children's faces, and camera on a tripod of the whole interaction). A multimodal approach to data analysis was taken, focusing on the combined analysis of body position and movement, gaze, and the detailed movement of the hands and fingers as kinds of touch (stroke, tap, scratch etc.). Results show differences in the movement of the fingers, types of touch and sequence of actions that children spontaneously make when drawing on paper as oppose to on the Tablet. Traditional finger painting requires a constant replenishment of paint on the finger resulting in a shift in focus of attention shifts the sheet of paper to the colour palette, while with the tablet touch itself is sufficient to generate a painted mark. Although individual differences were found, the time spent on drawing (i.e. touching) on the screen was greater than that of drawing on paper.

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Keywords: children, finger painting, Tablet, multimodal approach;

1. Introduction

Preschool-aged children show enthusiasm and motivation when interacting touchscreens on the mobile devices that surround them. Although research suggests such devices can act as tools that support learning through

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promoting students' creativity and increasing their motivation (Clarke and Luckin, 2013),,the specific advantages of using a certain technology in relation to educational activities or goals is not clearly supported by this data, making choices about technology for both educators and schools problematic. This results in ICTs being present in the classroom without fully exploiting them or integrating them effectively into an educational model based on the development of skills. A recent study conducted by the University of Wisconsin confirms that interactive screens are potentially an extremely effective resource for playing and learning during the first years of life (Kirkorian, 2013), indicating that the use of ICTs in nursery schools demands a radical change, surpassing the simple exposure of children to audiovisual content (TV programs or animated films on DVD, for example), to engaging them in the potentialities of interactive content.

The goal of this study was to explore young children's touch-based interaction with Tablets; particularly examining how a familiar activity likes finger painting might change in a digital context (using an iPad Tablet) versus a traditional physical context using paper and physical paint. Touch is a central part of our multimodal sensory system (Smith and Gasser, 2005). It is a fundamental way for children to interact and through which they begin to explore his or her environment during the first few months of life. This study contributes to the discourse on how environments - digital or physical - can support or limit the evolution of certain activities (like drawing), and importantly takes a multidisciplinary perspective drawing on pedagogy, developmental psychology and, in certain aspects, child-computer interaction.

2. The methodology issue

The methodological approach was qualitative, drawing centrally on multimodality, but with certain methodological differences in relation to multimodal data transcription techniques from the literature (Kress, 2009; Howes, 2013). One key difference was that, contrary to the typical multimodal methodological framework, no material selection was done prior to the transcription of data, but instead all the material in its entirety (N hours of video) was coded. The transcription, open but systematic, also allowed us to develop a database containing quantitative data to conduct a descriptive statistical analysis of the 5 activities proposed for each child. Three researchers participated in the transcription process, and collectively developed and agreed a touch observation system, providing inter-observer reliability.

The sample group was composed of 7 preschool children between the ages of 27 and 37 months (5 girls and 2 boys) from a London nursery school. Each child freely (with no time limit) explored three 'finger painting' applications on a Tablet device (making a drawing on a white screen, colouring in a black and white picture of an animal and making a drawing on a black page by spreading out paint in feathered patterns) and made two finger paintings on paper (a drawing on white A4-size paper and another colouring in the same animal picture also printed out on A4-size paper). The sequence of 5 activities was varied for each child; 4 children started with the 3 iPad activities and the other 3 with the sequence of activities on paper.

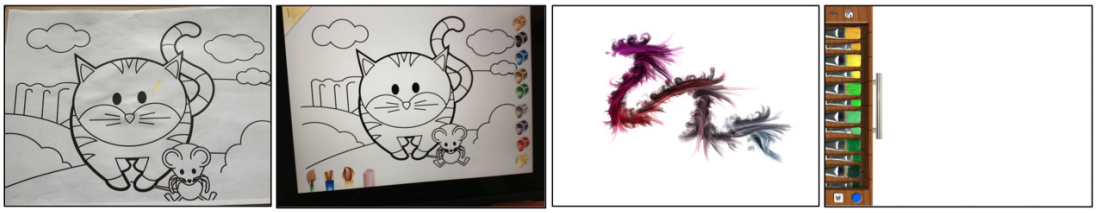

Fig. 1. (a & b) On the left, screenshot corresponding to the same figure of the cat to be colored in on paper and digitally on the iPad ("Color zoo"); (c & d) on the right, screenshots corresponding to the "Fingerpaint" App and the "Sketch Pad" App for free design.

Through a questionnaire delivered to their parents, we confirmed that the children in the sample group did not have great familiarity with mobile devices. On the other hand, the school's teachers and management confirmed their familiarity with finger painting on paper. This difference in familiarity was kept in mind when interpreting the results; although the study's goal was not to determine the best environment, but to identify the play and learning

potentialities, limits and advantages of each medium for each activity.

2.1. Material

We consider the material selection to be extremely important in order to achieve the study's goals, especially since before the age of 4, what is commonly called "concentration" when referring to attention control, is very limited. At the preschool age, children can focus their attention on a task or an action for just a few minutes straight (Ruff and Lawson, 1990; Stodolsky, 1974; Strutt, Anderson and Well, 1975). At the same time it was important to put the activities into practice sequentially, one after another, because children are very sensitive to the conditions of the environment, and to their own emotional state, which can drastically change their interaction process with an activity from one day to the next. While it was important not to limit the child's interaction time for each activity, it was necessary that they covered the proposed sequence of activities. We wanted to be able to compare the drawing and coloring activities in both the digital and the paper context, but also wanted to observe the child´s reaction when integrating a motivational element into the drawing activity, for example a digital effect in the iPad condition.

We selected three existing applications to do the drawing and coloring activities after analyzing a cross section of 17 drawing Apps ("Record Board", "Screen Shomp", "Show me", "Educacreations", "Color zoo", "Brushes", "Paint pad", "Sparkle Paint", "Finger Glow", "Doodle Buddy", "Fingerpaint", "Singing Fingers", "Line Brush", "Little Painter", "Coloring Drawing Pad", "Colorful shapes in motion"). The features taken into account were: (a) The option to use the App in Offline mode (b) whether the App featured multitouch capabilities (c) whether the App included the option to draw on a plain white screen (d) The number of visible screen elements (e) The number of visible colors in the paint palette (f) Rating on a scale of one to ten of the Children Computer Interaction (structure and navigation system, simplicity in interaction, usability and organization of information) (g) Rating on a scale of one to ten of the Graphical User Interface (visual attention, visual distribution, visual simplicity, readability, aesthetics and cultural references), according to Grané's theoretical model (2012). The Apps chosen were the most suitable ones for achieving the study goals.

Table 1. Apps chosen for the iPad condition

Name	Offline	Multi touch	White screen	Nº of elements	Nº of colors	CHI (1-10)	GUI (1-10)
Color zoo (finger painting using a picture of an animal)	Yes	Yes	No	6	9	7	7
Fingerpaint (drawing spread paint in feathered patterns)	Yes	Yes	Yes	6—0	Random	8	9
Sketch pad (blank screen with a digital paint palette)	Yes	Yes	Yes	9 (small)	1	7	7

2.2. Data collection and multimodal transcription

Data collection included video recordings from 4 different angles (micro-cameras embedded in the Tablet case to observe the children's facial expressions; video shots of the Tablet screen of everything happening on the iPad screen to observe the child's action sequence; the camera from a second iPad to record the movements of the child´s hands; and a camera on a tripod to observe the entire interaction). After synchronizing the recordings, 3 researchers transcribed the data using Inqscribe. The focus on transcription was on the number, types and sequences of touch, children's gaze and expression, gesture and body positioning. For example:

- Ex.1: Child 2, on paper, activity 3, duration 00:00:14.16, sequence "presses both hands, stretches all fingers apart/back together - then slides both hands with spread fingers up and down the paper (hand spread) long and hard drag and push x 12 - size increases as repeats- rocking whole body backward and forward in this action - the spreads fingers makes small up down movements with hand x 5".

- Ex.2: Child 5, on iPad, activity 5, duration 00:00:04.21, “looks up and away from screen, pleased expression. Holds finger in pointing position until turns whole body 90 degrees to side, then fingers relax together”.

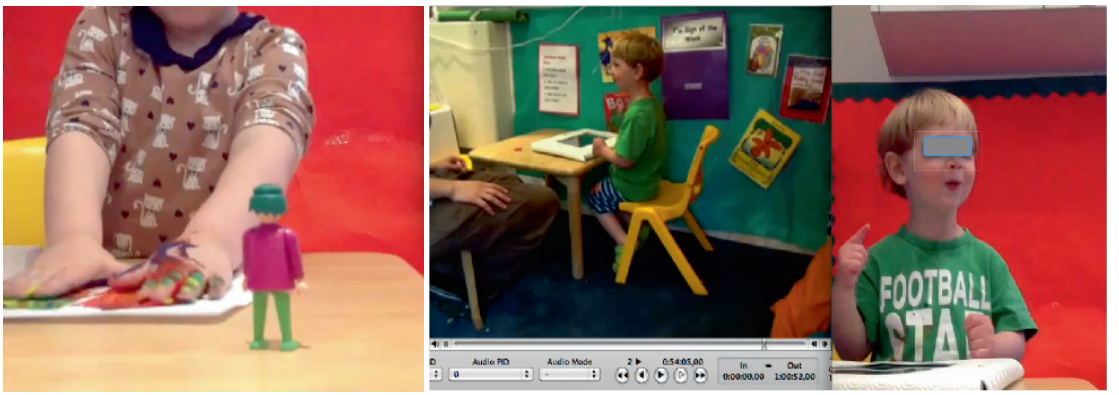

Fig. 2. (a) On the left, screenshot corresponding to example 1; (b) on the right, screenshots corresponding to example 2

3. Results

The results of the quantitative analysis indicate that on the whole, the children’s sample group spent more time on coloring in of the picture (as oppose to free painting); and much more even when the figure of the cat was presented on paper. The free drawing on paper or with effects in its digital version also had a similar duration to one another.

The number of times that there is a touch or a series of touches determined the duration of each activity and was proportional to it (Table 2). While we found large individual differences, the average number of touches per child was slightly higher in the iPad condition than on the sheet of paper (Table 3). Furthermore, the average time per child spent using the touchscreen was longer than that of those drawing on paper. Finally, it turned out that the maximum duration of a sequence of touches on the iPad was much longer in terms of time than on paper.

The features of the device itself allowed the child to continue to concentrate on his or her activity for longer sequences. For example, on digital platforms the color continues to be generated as long as the touch remains on the screen, enabling the activity to be extended, the virtual context allowed a prolonged painting process.

Table 2. Frequency and total duration of touches or sequence of touches

Activities	*Cat figure (iPad condition)*	*Free drawing (iPad condition)*	*Free drawing with effects (iPad condition)*	*Cat figure (paper condition)*	*Free drawing (paper condition)*
Touch or secuence of touches (7 children)	171	102	121	279	153
Duración	07:33	04:57	06:23	12:31	06:28

Table 3. Apps for the iPad condition

	Screen	*Paper*
Average nº of touches or sequence of touches for children	65	52
Average time spent for children	06:10	04:24
Max. duration of one sequence	00:27	00:18

4. Discussion and Conclusion

The results indicate that the environment (digital vs. physical) produces different kinds of painting processes, in particular. Although individual differences between the children were found, the colouring activity was found to last longer in the paper context, as it produced a greater number of gestures, through the need to collect paint from a palette and then apply to the paper. On the other hand, the number of actions children made spontaneously when drawing freely with the Tablet lasted longer and produced longer sequences of touch through the continuous visual effects. The study's limit is in the size of the sample group, which did not allow us to control, for example, the effect of age in the results. Nevertheless, the methodology has proven to be efficient for data collection and multimodal transcription and can be usefully applied to future research.

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