SketchCam: Creative Photography for Children

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ABSTRACT
This paper describes the design and early testing of SketchCam, a camera that lets children take pictures through sketching. Our observations of children's use of digital cameras led to insights about how children appropriate the screen in the picture-taking process. Inspired by their use of these cameras, we designed SketchCam, which enables children to capture images directly by sketching on a touch screen. We describe the results of our observations of children; the design of SketchCam, and the results of a preliminary study of a working prototype with four children aged three to six.

Author Keywords
camera, sketching, creativity, video, probes, ethnography, synaesthesia.

ACM Classification Keywords
H5.m. Information interfaces and presentation: H.2 User interfaces.

INTRODUCTION
As digital cameras have become cheaper and smaller, more and more children are allowed to use them. What happens when children become photographers? How have changes in technology affected their ability to use photography to explore the world around them and what can we do to further enhance their experiences?

To find out, we observed how four children, aged three to six, used their parents' digital cameras as a regular activity over the course of a month. We found that, more than producing real pictures or even framing reality, what fascinated them most was the screen. Looking at the world through a screen is magical: they can freeze time and replay it at will.

Based on this insight and our earlier studies of children and tangible cameras [5], we developed SketchCam, which reduces the camera to a single element: the screen. Instead of taking pictures by pressing a button, children trace a path on the image that appears on a touch screen. By combining sketching and photography, children can create any kind of new object they like, following contours or drawing meaningful shapes that they "fill with reality".

This paper discusses relevant related research and then describes the design and implementation of the SketchCam prototype. We describe a study of four children aged three to six and discuss the potential for blending photography and sketching.

RELATED WORK
For the past 30 years, researchers have explored computational photography for children. For example, the DynaBook and KiddiKomputer [4] projects manifested all the functions of an interactive audiovisual device for children. The daylight-readable "display transducer" of the DynaBook, combined with a recursive and visual (iconic) programming environment were intended to provide children with new ways to express themselves, everywhere. Twenty years later, the PenPal project [10] has enabled children to learn by creating images and sending them across the Internet to a real audience of friends, classmates, and teachers. Even more recently, research in audiophotography [8] and context-photography [7] have demonstrated interesting ways to go beyond the snapshot, by adding different kinds of sensors to the camera.

Unfortunately, these projects were only mockups, usually illustrating interaction on regular computers and not on dedicated working prototypes, mainly due to battery and miniaturization problems. Such research focused more on the software and conceptual design and less on how children actually interact with such systems.

On the other hand, collaborative sketching projects like KidPad [1], mobile learning with the Ambient Wood project [12] and tangible interfaces like I/O Brush [13] were all created as working prototypes, allowing children to produce a significant amount of situated content. Each project illustrated a specific interaction technique that blended figurative and abstract representations. They highlighted childrens' need for simple and expressive mechanisms in order to build complex and realistic representations. Building upon this idea, we present the design and implementation of SketchCam, a camera that allow children to take pictures by sketching.

SKETCHCAM PROTOTYPE

The SketchCam hardware consists of an 8-inch touch screen connected to a video sensor (a generic webcam). The whole device weighs less than 700 grams and children can easily grab it with one or two hands. The computer is a 1 Ghz ultra-mobile PC, a mix between a PDA and a Tablet PC. This device is very useful for experiments since it has standard USB inputs, a good amount of RAM (512 Mo) and is very light and small. The software is written in Java, using Proce55ing environment and Quicktime for Java. The code is open source and available online.

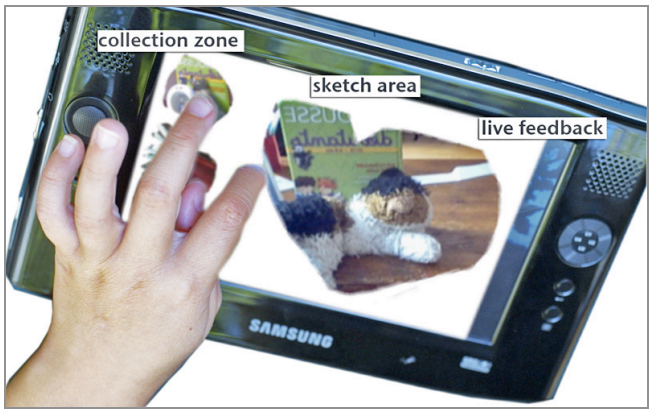

Figure 1: Sketchcam prototype

In order to take a picture, children sketch a continuous path on the touch-sensitive viewfinder that displays the live video feed captured by a cmos sensor embedded in the back of the device. As they release their finger, this zone is then cropped and displayed as an object. To keep an object, the child clicks on it; to delete it, she clicks outside the object. All objects are recorded as a collection, defined as a set of objects. Children can then make collages, using drag-and-drop to combine different objects.

Interaction takes place directly by touching the screen; there is no button or menu on the device itself. We opted for very simple interactive sequences, following Kay's [4] recommendation to design for children as young as possible. An important design issue is how to handle the basic interaction of switching between "record" and "play" states: How can we indicate these two states to very young children? How can we help them to navigate between reality (the live video they see on the screen) and its representation (the still frame they capture)?

We decided to create two specific zones: *record* on the right and *play* on the left. The left sides serves as the collection area where objects, sketched photographs, are archived. If a child wants to access a previous object, he can click on it and browse the collection, ordered by time. To return to *record* mode, he clicks on a 20 pixel-wide strip on the right, which brings back the live video feed. We avoided creating icons that represent something absent, choosing instead to always display direct meaning, here the video feed.

USER STUDY

We were interested in different kinds of comparisons between SketchCam and regular digital cameras, afforded by three different perspectives. We gathered *quantitative* measures, which consisted of recording and analyzing the number of shots, shot selection rate and error rate (how many pictures or objects were deleted by error). We also made *qualitative* observations and classified the categories of visual artifacts the children produced. Grounded in their practices, this second perspective manifests the semiotic differences between the devices. Finally, we tried to understand the level of *emergent* activities manifested by each device. By emergence, we mean how these machines let the children create new behavior, functions or meaning through exploration and free playing.

We used this three-tier (quantitative, qualitative, emergent) observation and data collection strategy for a period of two months with four children aged three to six. We recorded quantitative data in a machine-readable format and took photographs and video recordings of children using each of the devices: a regular digital camera with a 2.5-inch screen and SketchCam. Note that much of the qualitative material was produced directly by the children: they also acted as data collectors, and their points-of-view were as valuable and legitimate as ours. The devices acted both as the focus of observation and observation tools in their own right, acting as technology probes [3].

RESULTS

From a quantitative perspective, SketchCam increases the number of shots and selections made by children while maintaining a similar error rate, i.e. accidentally deleting an image. In equivalent periods, children using SketchCam produced, on average, twice as many pictures. With a digital camera, they produced 40 pictures per hour and more than 80 pictures per hour with SketchCam. One

possible explanation for the increased level of engagement is the physicality of the interaction, which reminds them of drawing and lets them take advantage of their existing sketching skills on regular paper. Whereas a trigger button provides an instant emotion, tracing a contour or creating a shape provides a dense and continuous somatic feedback. Children in this age range often look for activities that provide pleasurable energetic feedback that links cognitive and somatic processes [9].

Figure 2: sketching sequence

From a qualitative perspective, we found that the photographs and objects produced by the two devices were often on the same topic. The children took pictures of objects and people in the immediate vicinity, such as toys, people, and landscapes. Yet there were clear differences in what they focused on with each type of camera, clearly manifested in the artifacts they created. With regular digital cameras, they often photographed complex scenes, creating a global view of many objects. With SketchCam, they were more likely to target individual objects. Note that this provided more specific evidence of the focus of their attention and offered a pragmatic way for us to understand young childrens' intentions. (Classic methods such as interviews or tests often offer mixed results.)

Figure 3: comparison of a photo taken in camera mode (left) and in sketch mode (right)

Finally, we were interested in the emergent properties (in the form of unexpected artefacts) associated with each device. They discovered how to play with the frame, the angle or the focus on the regular digital cameras. However, SketchCam added new expressive functionalities, specifically the possibility to create a specific frame shape. With regular cameras, the picture appears in a rectangular frame. SketchCam allowed children to create their own frames, based on what they thought would best suit their photograph.

Figure 4: "My Cat in an Heart", using the frame as an expressive mechanism

This led to an interesting result: We expected the children to trace a contour to take pictures, which they did. But a new pattern quickly emerged in which the children created meaningful shapes, such as a heart, which they then "filled" with the appropriate picture. Unlike the digital camera, in which they explicitly took a picture of 'reality', with SketchCam, they use 'reality' as a texture to fill a particular shape they created. The classic example is the heart that the children filled with relatives (Mum or Dad) or valued objects (teddy bear, bags or jewels).

DISCUSSION

The combination of sketching and photography opens intriguing opportunities both for children and for researchers. In terms of video ethnography [14], these devices can help capture children's creative practices. Used as mobile probes [2], they provide more detailed views of the creative process and artefact generation as compared to regular photography. By providing expressive frames, SketchCam highlights the precise focus of a child's attention. In the future, we envision using these shapes as metadata for the development of a visual search engine to browse through picture collections.

Creating framed visual objects instead of rectangular pictures also opens interesting opportunities. For example, software programming environments such as Scratch [11], are designed to let children animate visual objects to create computer games. Unfortunately, these young programmers must also learn how to remove unwanted backgrounds from their images via complex software such as Photoshop. SketchCam eases this process by letting children directly capture realistic objects they can then use in other computer applications.

Combining sketching and photography also bridges two levels of representation in a continuous manner. We would be interested in observing how very young children use

devices that encourage visuo-motor coordination and awareness. If seeing is “touching with the eyes”, sketching photographs could also develop mechanisms such as “seeing with the hands” leading to a subtle development of synaesthetic skills that are essential for the construction of creative personalities.

CONCLUSION

We presented the design and implementation of a working prototype of SketchCam, a digital camera that allows children to take pictures by sketching. We described an early user study that examines quantitative, qualitative and emergent criteria and discussed the results. SketchCam allowed children to take pictures more easily than regular digital cameras and allowed them to make collections of objects they have selected. The prototype also led to unexpected and emergent behavior such as the reconfiguration of an existing function of the system (contour) to a more expressive one (meaningful frame creation).

We plan to continue development of SketchCam, notably in terms of design and software. We envision a video-editing module that will let children write visual stories as they sketch pictures. The idea is to provide them with a tool that allows them to ‘write pictures’ as they already ‘write words’. In order to connect these stories to their friends and families; we will implement a social network module that uses electronic jewelry as the interface [6].

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