Context Photography: Modifying the Digital Camera Into a New Creative Tool

Sara Ljungblad, Maria Håkansson, Lalya Gaye, Lars Erik Holmquist
Future Applications Lab, Viktoria Institute
Box 620, 405 30 Göteborg, Sweden
www.viktoria.se/fal
{saral, mariah, lalya, leh}@viktoria.se

ABSTRACT
Context photography consists of capturing context when taking a picture, by sensing physical input in addition to light and representing it visually in real time. By developing this concept, we explore alternative potentials of digital cameras as everyday creative tools. We have developed two prototypes and tested them in user workshops. Based on the results of this process, we present implications of such modifications of underlying characteristics of a still camera.

Author Keywords
Context photography, digital cameras, everyday creativity.

ACM Classification Keywords
H.5 INFORMATION INTERFACES AND PRESENTATION (I.7): H.5.2 User Interfaces

INTRODUCTION

The presence of digital cameras in people's everyday life is increasing rapidly. They are being integrated with other devices, such as mobile communication tools (e.g. camera phones), and the quality-price ratio of digital cameras is continuously improving. As creative tools, digital cameras have the potential to go beyond the mechanical and optical constraints specific to analogue cameras. However, for the average photographer, taking pictures with a digital camera is still very similar to its analogue counterpart. In order to explore alternative means of creating pictures, we are developing a particular concept, *context photography*. This consists of capturing more than incoming light in an image, i.e. the *context*. Information about the physical context gathered from various sensors visually affect pictures as they are taken, and open a new scope of possible experiences and practices. Translating non-visual data into visual effects in an image modifies the relation between input and output in the camera. Where previously a camera would only sense light and fix it as a still image in a way that could be considered as objective (because only depending on the laws of physics), this interpretation adds a new dimension of subjectivity. What implications do such modifications of underlying characteristics of a camera have on how it is conceived and used? In order to explore these questions, we have designed two camera prototypes and tested them in user workshops. This paper describes the design of the prototypes, presents feedback from the workshops and introduces implications of modifying the digital still camera into a context camera.

Figure 1: Workshop participants (a, c) taking pictures of a departing train (b), and screaming to pixelise a portrait (d). All pictures are best viewed in colour.

RELATED WORK, TECHNOLOGIES AND PRACTICES

Integrating context information with photos has been explored in research projects by adding audio to images. The *Audiophotography* project [2] focused on means of allowing users to annotate images with audio, whereas *RAW* [1] used automatically recorded ambient sound with pictures to convey genuine impressions of everyday life. Other projects have developed *new interactions*, by adding sensory properties to a camera or modifying its affordances drastically. *StartleCam* [3] triggered video recordings by arousal, *LAFCam* [5] used laughter detection to index points of interest when recording video, and *Cinema Fabriqué* [7] allowed users to edit video streams in real

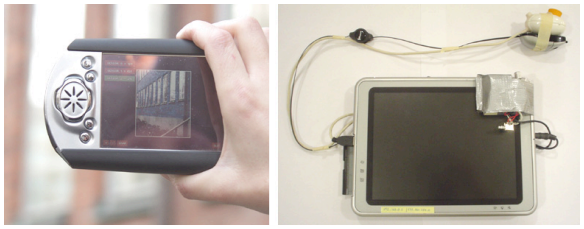

Figure 2: a) Concept prototype; b) interaction prototype

time through gesture and speech input. Again in the *Audiophotography* project [8], the designers explored how the physical affordances of a camera invite certain use, and constrain what pictures can be taken.

Current trends in consumer digital photography show an increasing interest in the *use of meta information* surrounding pictures for subsequent use, giving rise to new services and user experiences. For example, digital pictures can now be saved with related GPS information, allowing people to send MMS (Multimedia Messaging Service) linked to map positions of where the pictures were taken (e.g. with the camera phone KDDI A3012CA). In terms of *built-in visual manipulation* programs, graphical enhancements to digital images are increasingly being provided to e.g. camera phones as frames or filters to MMS (e.g. sketch filters in the Samsung SGH-E700) and to digital cameras as filtering options or predefined settings (sepia, black-and-white). By capturing infrared radiations and showing them as colour patterns, IR cameras *visually represent* temperature - i.e. invisible context data - but without sensing visible light. Finally, our approach to photography is inspired by amateur photography societies, such as the *Lomographic Society* [6], that playfully and open-mindedly *explore the limits* of everyday analogue photography.

PROTOTYPING A CONTEXT CAMERA

To explore context photography, we have designed two prototypes, each with a specific purpose: concept prototyping and interaction prototyping.

Concept Prototyping

The first step of the design process was to envision and develop the concept of context photography through preliminary user workshops and rapid prototyping (for more details see [4]). The workshops involved two groups of amateur photographers: traditional photography students and lomographers. New ideas emerged, mainly about *how* to express context in photography. As an outcome of these workshops, we built a first prototype to serve as a basic tool to help imagining what pictures reflecting context might look like, without having to commit to a specific hardware or a definite implementation. We opted for simulated sensor values mapped to simple visual effects, that would affect what the camera points at in real time and be continuously visible on a viewfinder. The prototype consists of a digital camera mounted on a handheld computer, with the screen acting as a viewfinder (Figure 2.a). The software affects the parameters hue, saturation and value. The user manually modifies the simulated sensors values. With a similar size-factor and shooting mechanism as a regular digital camera, the device emphasises real-time image manipulation properties over interaction possibilities.

Interaction Prototyping

The next step was to develop an interaction prototype for testing simplified yet realistic use, as well as to explore issues related to real context input. The development of the second prototype was done in collaboration with a graphical software developer who implemented a simple software prototyping platform and a set of effects. *Vectorial movement* and *sound level* were chosen as input. We wanted to emphasise the fundamental properties of the effects instead of their specific design. Out of a series of several options proposed by the developer, we chose a set of various effects that we grouped in combinations of one "movement" and one "sound" effect, based on how well they would fit together. This diversity was important in order to avoid focusing on the visual properties of one particular effect. The effects were linked to the input with a simple one-to-one mapping strategy.

To enable more complexity, the prototype is implemented on a Tablet PC, with the screen acting as a viewfinder, and all processing is performed by a C++ software program (Figure 2.b). A webcam serves as a lens, and a small mouse taped on top of it is used as a trigger. A condensator microphone connected through a small pre-amplifier, measures the sound level. Movement is retrieved as a vector field from the differentiation of subsequent images captured by the webcam. Input is calibrated to default values corresponding to a normal image without effects. Effects combinations are the following:

1. Small white dots follow the movement as a decreasing trace + pixel size increase with sound level (Figure 1.d)
2. Traces of coloured shadows follow the movement + the rest of the colours evolves towards a grey scale with increasing sound level (Figure 3.a)
3. "Swimming-pool" effect + colours evolve towards a grey scale with increasing sound level (Figure 1.b)
4. Extreme zooming on movement + colours evolve towards a grey scale with increasing sound level (Figure 3.b)

The user points with the webcam, sees the image and its real-time effects on the viewfinder, takes a picture by left-clicking on the mouse, and changes effect combinations by right-clicking. When a picture is taken, an audio feedback is heard; the image freezes a couple of seconds on the screen, and is saved as a JPEG file.

EVALUATION WORKSHOPS

The aim of the workshops was to evaluate our concept and get feedback from users trying out the interaction prototype.

We chose to involve two different groups of users in two different settings, in order to get diverse feedback. The participants of the first workshop were two of the previous lomographers, and one amateur photographer (2 males and 1 female). Those of the second were two high school students (2 females) interested in photography. Instead of staying in a lab, we chose to conduct the workshops in everyday settings. Due to difficult weather conditions, we opted for indoor yet relatively dynamic settings: the local central train station and a high school.

The workshops were conducted in similar ways and both lasted about 2 hours. The sessions were documented with video- and audio- recordings, written notes, and photographs. We started by explaining context photography, using the concept prototype to illustrate the idea and make it more tangible. Then, we told them how the interaction prototype functions technically, but took precautions not to influence how they would use it. After having stressed the fact that switching between effect combinations was only for evaluation purposes and was not meant to become a feature of an end-product, we let them try out the interaction prototype in an informal way. We neither gave specific tasks to fulfil other than to take pictures, nor restrictions on time. Finally, we held a semi-structured discussion about the concept of context photography, their experience of the prototype, general characteristics of the effects and suggestions on improvements. The photographs taken with the prototype served as references during the discussion.

Workshop 1: Central Train Station

The lomographers were already familiar with the concept of context photography. They usually capture peculiar everyday situations with lomo-cameras, and enjoy waiting for pictures to be developed. One also uses a camera phone. The third photographer was new to the concept. She uses a digital system camera and likes to take carefully planned pictures, mostly of nature.

During the test, the participants collaboratively managed the prototype (Figure 1.a), as they moved around the station. They focused on exploring and trying to understand the effects, and used different strategies to affect the sensor input, such as whistling or clapping, but for the most *finding sources* of noise or movement in the environment. They stopped the session after about 30 minutes.

In general, the users considered the concept new and interesting and thought that most of the pictures had turned out great (overlooking the poor image resolution). They stated that they would have been proud of such pictures *if* they had taken them with their regular cameras, and that the prototype created a "shortcut", a way of "*cheating*" to reach the "mistakes" or the "special feeling one wishes to capture". The subjects referred to "mistakes" as development or optical errors giving rise to nice unexpected pictures, which are difficult to plan for. They considered that taking a picture with the prototype had become *too effortless*. Besides, they felt that it did not support *personal expression*. One participant said that "all pictures turn out great now, regardless of who the photographer is" and pointed out the importance of being *unique* as an artist. The lomographers suggested for example biometric input as a way of increasing personal expression. The effects were also considered too *extreme*, possibly boring in the long run. The participants believed that the effects should be *subtler*, as critical parts of the picture were sometimes ruined, e.g. facial expressions. They suggested that effect colours should be lifted from the existing scene rather than overlaid, and that effects should somehow only be *attainable in real time*: "It has to be something special, otherwise you might just as well add the filters afterwards". The participants experienced difficulties with *default parameters* such as the camera's high sensitivity. For instance, they thought that the camera overreacted to their involuntary hand movements when they perceived to be holding it still. They were also concerned about neither being able to choose default features nor to customise the device, as they thought these would help supporting their *control* and personal expression. One considered the prototype more as a *motion camera* than a still camera. Seeing the movement effects in action sometimes made her forget to take pictures, as she fancied them more than the final images. The others did not like seeing the effects constantly, and would rather see them *once the picture was captured,* as it would be more exciting.

Figure 3: Effect combinations 2 and 4: a) shadows following movement; b) zoom on departing train.

Workshop 2: High School

Both participants were new to the concept of context photography. They take traditional photography classes at school. Otherwise, they enjoy taking snapshots of friends, family and activities to keep memories of everyday moments. Artistic expression is also important to them.

The participants quickly understood the concept. They paid little attention to existing sources of movement or sound in the environment. Instead, they *actively* created sensor input by waving, walking, jumping, screaming, and talking as they moved around the building. They took turns managing the prototype and stopped after about 20 minutes. In this session, due to a software error, the image did not freeze when a picture was taken, which made it difficult for the participants to know what was required to create a particular picture. Although this frustrated them during the picture-taking, they got more pleased with the overall

experience once they got to see during the discussion how the pictures had turned out.

They had divergent opinions about the concept, both positive - "I like the feeling of representing sound with something visual, it's very cool" - and sceptical to how it was embodied. As the participants of the previous workshop, both of them found the camera to be *too sensitive* to hand movements, wished for *customisation* possibilities - such as choosing colour settings, what input to incorporate and how - and also stated that the nature of the effects should be *specific to real time* as opposed to post-editing. Besides this, they expressed a wish for *richer, more interpretable* representations of the input. One wished the "sound" effects could be applied to the sound source only, as opposed to the whole image. They both preferred pictures where a movement's history was shown clearly rather than ambiguously. They preferred effects that *cannot be obtained with a regular digital camera,* one expressing a strong predilection for representing sound level with pixel size, and both discarding the black-and-white effect. "I thought it was one of the best [the pixels], that it was obvious that it was something else than what light and a lens can do." Both participants regarded the prototype as a *still* camera and assented when asked if they considered it possible to *learn* how to take good pictures with it.

IMPLICATIONS

This diverse feedback gives several indications on what it implies to modify the still camera into a context camera.

- Using such a camera can reduce the feeling of personal expression if the designer's subjectivity and constructs dominate over the user's own.
- If the camera generates aesthetically pleasing images independently of how much effort the user puts into obtaining them, this can be experienced as cheating.
- Visually incorporating meta data into images is a new, untraditional form of representation. Although this representation could be considered as a specific language to learn, some might want to create their own.
- Environmental parameters affect the resulting image, but the user cannot control their behaviour, or how the camera measures and incorporates them into the image. Looking for suitable sources of input in the environment, creating them self, or even customising defaults settings (e. g. calibration) can however increase the user's control.
- The user might experience the context as different from what the camera measures and represents.
- How the image is made visible during use can change one's perception of what a camera is (i.e. a still or motion camera) and of how to use it.

UPCOMING ITERATION

Based on these observations, how do we design context cameras that enable people to take untraditional yet satisfying pictures? What kind of photography would it support? In order to answer these questions we will go through a new prototyping and evaluation iteration. This includes applying some participants' suggestions we found relevant. We will represent context more clearly by mostly using effects that differ from traditional digital photography and by only affecting specific parts of the image. In order to try reducing the impact of the designers' subjectivity on the images, we will use subtler effects, in fusion with the scene. On a hardware level, we consider allowing users to calibrate the amount of sensor input themselves. We will test only showing the effects after the picture is taken, to increase suspense and to avoid the motion picture feeling that someone experienced. Finally, we will explore different possible mapping strategies.

CONCLUSION

By exploring the concept of context photography, we found several consequences of modifying the still camera so that it also senses context and interprets it visually. In the next step of the project, we will try different solutions to overcome these design challenges.

ACKNOWLEDGMENTS

We wish to thank Pontus Munck and Panajotis Mihalatos, for implementing the concept prototype, respectively the interaction prototype and the graphical effects. Thanks to all workshop participants, and to FAL for their feedback. This project is funded by the Swedish Foundation for Strategic Research through the *Mobile Services* project.

REFERENCES

1. Bitton, J. and Agamanolis, S. RAW: Conveying Minimally-Mediated Impressions of Everyday Life with an Audio-Photographic Tool. *Proc. of CHI'04*, ACM Press (2004).
2. Frohlich, D. and Tallyn, E. Audiophotography: Practice and Prospects. *Proc. of CHI'99*, ACM Press (1999).
3. Healey, J. and Picard, R. W. StartleCam. A Cybernetic Wearable Camera. *Proc. of ISWC'98*, Perceptual Computing Technical Report nr. 468 (1998).
4. Håkansson, M., Ljungblad, S. and Holmquist L. E. Capturing the Invisible: Designing Context-Aware Photography. *Proc. of DUX'03*, ACM/AIGA (2003).
5. Lockerd, A. and Mueller, F. LAFCam. Leveraging Affective Feedback Camcorder. *Proc. of CHI '02*, ACM Press (2002).
6. The Lomographic Society http://www.lomography.com
7. Manor, J. *Cinema Fabriqué: A Gestural Environment for Realtime Video Performance*. MSc thesis in Media Arts and Sciences, MIT, USA, 2003.
8. Martin, H. and Gaver, W. Beyond the Snapshot - From Speculation to Prototypes in Audiophotography. *Proc. of DIS'00*, ACM Press (2000).