

Crowdpainting with Light: Participatory Imaging at the Big Shot

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Abstract

Painting with light is a night photography technique where the photographer illuminates the subject with moving lights over a long exposure time. The Big Shot project has taken this technique to the extreme over the past 30 years by engaging large crowds for the lighting of landmarks resulting in unique night photographs. In this paper, we overview the fundamental techniques of crowd-painting with light and show representative examples of images taken through the years. We also discuss some of the social aspects of this participatory experience that make it memorable and engaging. Finally, we propose computational techniques for painting with light and demonstrate, through a small experiment, how crowd painting with light can be accessible to broad audiences for experimentation, social interaction and fun.

1. Introduction

How many flashlights does it take to illuminate a building for a night photograph? Is it enough to have 50, 100 or 1000 flashlights? And why does it matter? This paper discusses the RIT Big Shot project, where the crowd actively participates in illuminating the subject of night photographs. This Big Shot project started in 1987, has grown in numbers and complexity [1], [2]. It began with film cameras and 40 participants, and has evolved to using digital cameras and thousands of participants.

In this paper, we overview the fundamental techniques of taking such extreme pictures with the objective of motivating more groups to take on such projects and open new directions involving computational techniques. We also discuss some of the social aspects of this participatory experience, which make the Big Shot experience fun and worthwhile.

The wide availability of large image datasets in recent years has motivated novel processing techniques for creating large image structures from smaller image parts. Notable examples include automatic panorama stitching [3], [4] and 3D browsing of photo collections [5], [6], [7]. In addition to leveraging image content in the spatial domain, there is opportunity to exploit illumination

changes over time for the formation of new images. Sections 2 and 3 discuss painting by light techniques used for Big Shot photographs. Section 4 suggests a new approach to painting by light using bursts and Section 5 concludes the paper.

2. Painting with Light

The technique called painting with light is well known among night photographers. The subject is in the dark and the photographer provides the illumination using a moving light source to illuminate parts of the subject during a long exposure time. The end result can be visually striking and may vary significantly based on the photographer's interpretation of the subject through the selection of illumination intensity at various parts of the image.



Figure 1. The Pile Gate at Old Town, Dubrovnik, Croatia, 12 April 2007, 8:30pm. Direct Digital Capture with Nikon D200 camera. Exposure time: 90 sec. with 20mm lens, f11 aperture setting. All external lighting was provided by approximately 478 people handling flash units and flashlights.

A prime example of a Big Shot photograph is shown in Figure 1 where approximately 478 people provided all external illumination with hand held flash units and flashlights. Looking at the image of Figure 1, one might ask: Where are the hundreds of people who are lighting the scene? When people move fast across the scene without getting illuminated during a long exposure, their silhouette does not contribute any light to the scene and they become effectively “invisible” to the camera. The

only visible people are the actors on the bridge who are dressed in period costumes. They were also illuminated by a handful of other people who quickly moved away from the scene.

Another question might be: How does the flag stay still during a long exposure? The answer is: it doesn't have to. A carefully positioned participant was there to illuminate the flag while upright for about 5 seconds while the flag was held off the pole using monofilament fishing line.

The image of Figure 2, the historic Erie Canal, is another intriguing night image illuminated by over 600 participants. The deep blue color of the sky is not commonly found in night photography. This was accomplished by carefully planning the shot during twilight (8:50pm) when the blue color of the sky was still present. The nonuniform lighting of the silos and buildings in the background is indicative of the difficulty of achieving uniform illumination when painting with light. The stillness of the boat during a long exposure is not simple to achieve because the currents of the canal were strong enough to sway the boat even if it is anchored. Dealing with these multiple factors and coordinating hundreds of people illustrates the magnitude of the project and the planning needed for the Big Shot projects.



Figure 2. Erie Canal at Pittsford New York, May 8, 2008, 8:50pm, Camera: Nikon D3 with 40 mm lens Exposure time: 30 seconds @ f16 ISO 200. All external lighting was provided by approximately 615 people.

The camera settings are typically exposures that range from 30 seconds up to 2.5 minutes at f11 to f16 so that the entire landmark is in focus. Some recent Big Shot photographs use image stitching to achieve a wider field of view, e.g. four cameras were used for the 2015 photo at Churchill Downs shown in Figure 3.

One of the motivations of this paper is to demonstrate that computational techniques can be used to remove some of the difficulties where different timing is required for different parts of the image. Another objective is to bring these techniques to a broader audience for further experimentation and development of novel techniques involving crowd-painting.

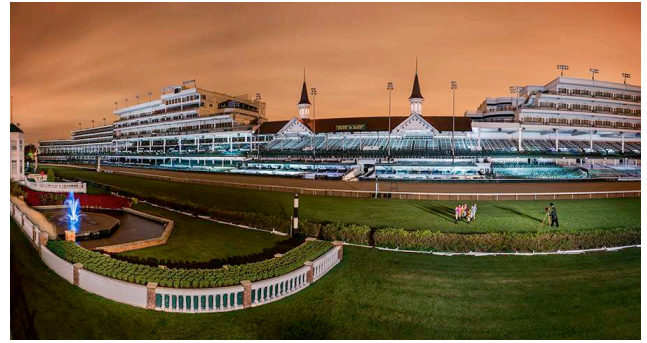


Figure 3. Churchill Downs, Louisville Kentucky, October 3, 2015, 9:09pm. Cameras: Four Nikon D810 cameras; Lenses: 28/f1.8 mm; Exposure time: 30 seconds @ f/11 ISO 100. All external lighting provided by nearly 1,800 volunteer participants and Profoto 7B and B1 electronic flash equipment.

3. Crowdpainting with Light

Painting landmarks with light has its roots in architectural and other types of photography dating back to the early 1900's. The original purpose of the RIT Big Shot project was educational, geared toward teaching photography students/enthusiasts about the use of photographic flash and lighting. Buildings and landmarks became natural subjects for the early photographs of the project. Through the years, the scope and impact of the project have grown, as photography grew from film into the digital domain, yet one of the constants has been the participation of people.

Part of the challenge as well as the fun of the Big Shot experience is to organize the people that illuminate the scene. Orchestrating large crowds takes months of preparation and planning and does not end until the photograph is taken. The team of organizers starts with planning the approximate number of people and assigns zones for each group of people to light.

There is a hierarchy of organizers that includes team leaders that give directions and manage the group for a particular zone. An unexpected outcome of the experience was the leadership skills that many students developed going from participants to team leaders and organizers. There is a strong sense of community among the participants and the organizers make it a point to have the photos ready and distributed shortly after the event for all to share. The excitement of the event continues during the sharing process, as every participant points out their zone to their friends and family.

When the landmark is large and well known, such as the ATT Stadium formerly Cowboys stadium in Figure 4, and a large crowd gets involved in the lighting process (around 2,500 people for that picture), it becomes impossible to completely hide the people and they are incorporated into the picture. The before and after pictures of the stadium show people in the parking lot before the shot and their handheld lights as they move during the taking of the shot.

The colors in the skies of several photographs reveal the difficulty the team faces with weather conditions. Big Shot is a rain or shine event. The distance between the camera and the participants point to the challenge of coordinating the timing of the shot, i.e. the shutter opening and closing, and the lighting of the subject by the people. In addition to walkie-talkies and bull horns, platform lights that flash and change colors give cues to the large crowd of when the shutter is about to open and when it is open.

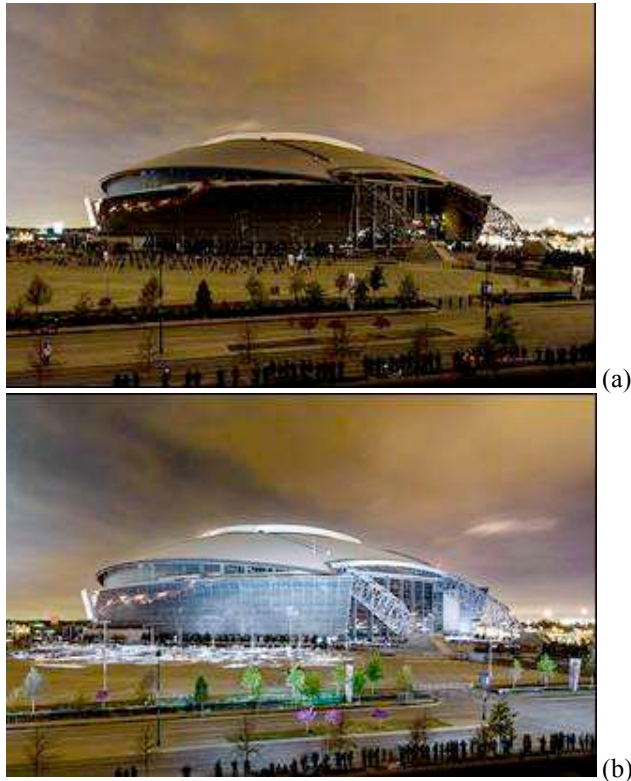


Figure 4. Cowboys Stadium, Arlington, Texas, top: before and bottom: after light painting by approximately 2,430 people. March 23, 2013, 9:05pm. Camera: Nikon D800 with 14 mm lens. Exposure time: 30 seconds @ f16 ISO 400.

Additional Big Shot images [8] are shown in Figure 5. Each of them illustrates various conditions, such as snow at the George Eastman House and pouring rain at the Smithsonian Museum of the American Indian. The picture at the Intrepid, Sea and Air Museum was the first time that there was a sizable distance between the subject and the camera. The picture of the Alamo was a risk of overexposure due to the large numbers of people that participated. The hotel in the background added an interesting complication on how to ask all the rooms to turn off their lights during the photo shoot.

Despite all of the effort required, the end result and the participatory nature of this imaging experience make it compelling and engaging.



Figure 5. From top to bottom: (a) George Eastman House, 1988; (b) Intrepid, Sea and Air Museum, 1999; (c) The Alamo, 2001; (d) Smithsonian Museum of the American Indian, 2009.

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4. The Small Shot: Crowdpainting in Bursts

A question that we ask is how to incorporate digital imaging techniques to overcome some of the challenges involved when crowdpainting with light by smaller groups. A main difficulty involves even lighting of various parts of the subject, some of which may be moving, without overexposing any parts of it.

The solution that we propose is to take multiple images with shorter exposures, instead of a single image at longer exposure. The advantage of this approach is that some of the information in the short exposures can be discarded or minimized by proper weighting. The resulting image can be obtained through a weighted averaging of the shorter exposures, such that regions that are at risk of getting overexposed are weighted less than regions that are underexposed. This simple method enhances certain aspects of the subject while keeping overexposure under control.

We demonstrate the concept by performing an experiment where 48 images of a fireplace scene were captured at 4 sec exposures each. The camera was a Cannon Rebel T3i camera with f11 aperture setting and ISO 200. Representative images of the individual shots and the overall results of full averaging and weighted averaging are shown in Figures 6 and 7.



Figure 6. Examples of individual images of fireplace scene obtained by painting by light over 4 sec exposures.



Figure 7. Fireplace scene painted by light. Top: Overexposed image obtained by integrating 48 individual images similar to examples shown in Figure 6. Bottom: Image obtained by weighted averaging of the 48 individual images.

5. Conclusions

This paper provided an overview of crowdpainting with light at the RIT Big Shot participatory imaging project. We propose a twist in the image capture process by acquiring multiple images at moderate exposures instead

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of a single image at long exposure. A weighted averaging scheme was introduced to reconstruct a photograph that simulates the result of a long exposure while eliminating overexposure. This technique is more flexible and forgiving, and can be used when smaller groups are interested in crowd painting buildings or landmarks one zone at a time or when dealing with moving objects.

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