Shadow Calligraphy of Dance

An Image-Based Interactive Installation for Capturing Flowing Human Figures

Lyn Chao-ling Chen
Artist-in-Residence
Banqiao 435 Art Zone
New Taipei City, Taiwan
lynchen@ntu.edu.tw

He-lin Luo
Department of Journalism
Shih Hsin University
Taipei, Taiwan
helinluo@mail.shu.edu.tw

ABSTRACT

In the artwork, the topic of flowing human figures has been discussed. People pass through familiar places day by day, in which they create connection among them and the city. The impressions, memories and experiences turn the definition of the *space* in the city into *place*, and it is meaningful and creates a virtual layer upon the physical world. The artwork tried to arouse people to aware the connection among them and the environment by revealing the invisible traces. The interactive installation was set in outdoor exhibition, and a camera was set align the road and a projector was used for performing image on the wall of the nearby building. Object detection technology has been used in the interactive installation for capturing movements of people. GMM modeling was adopted for capturing frames with vivid face features, and the parameters was set for generating afterimage effect. The projected picture on the wall combined with 25 frames in different update time setting for performing a delayed vision, and only one region in the center of the image played the current frame in real-time, for arousing audience to notice the connection between their movements and the projected picture. In addition, some of them were reversed in horizontal direction for creating a dynamic Chinese brush painting with aesthetic composition. The remaining figures on the wall as mark or print remind people their traces in the city, and that creates the connection among the city and people who has been to the place at the same time. In the interactive installation, the improvisational painting of body calligraphy was exhibited in a collaborative way, in which revealed the face features or human shapes of the crowd in physical point, and also the collaborative experiences or memories in mental aspect.

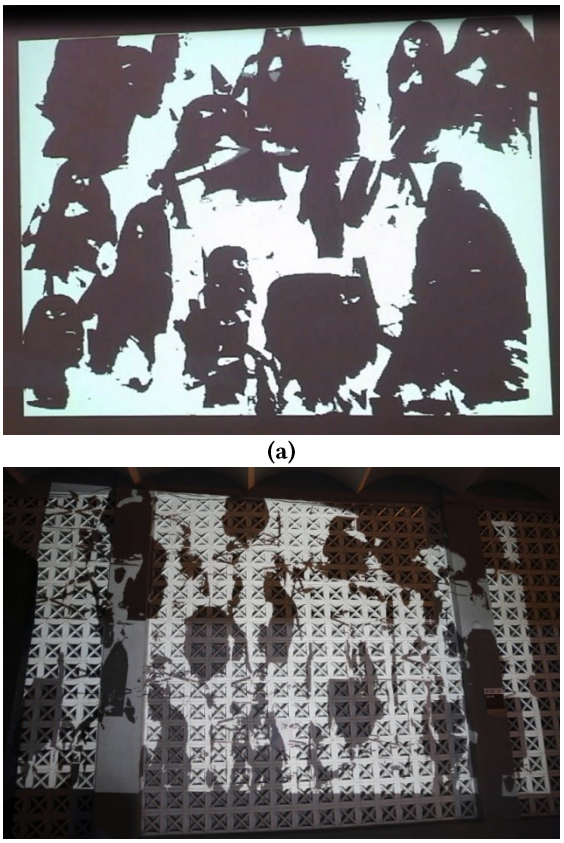
CCS CONCEPTS

•Applied computing • Arts and humanities • Media arts

KEYWORDS

Interactive installation; image sequence analysis; psycogeography

ACM ISBN 978-1-4503-5665-7/18/10.
https://doi.org/10.1145/3240508.3264576



(a)

(b)

Figure 1: Interactive mode: (a) single player, (b) the passing crowd in the outdoor performance [1].

ACM Reference format:
Lyn Chao-ling Chen and He-lin Luo. 2018. Shadow Calligraphy of Dance: An Image-Based Interactive Installation for Capturing Flowing Human Figures. In *Proceedings of ACM Multimedia Conf. (MM'18). Oct. 22-26, 2018, Seoul, Republic of Korea.* ACM, New York, NY, USA. *3 pages.*
https://doi.org/10.1145/3240508.3264576

1 Introduction

The artwork is an image-based interactive installation, and the concept of the artwork tries to arouse awareness of connection among people and the city they used to be familiar (Fig. 1(a)). The artwork enables creating body calligraphy painting intuitively

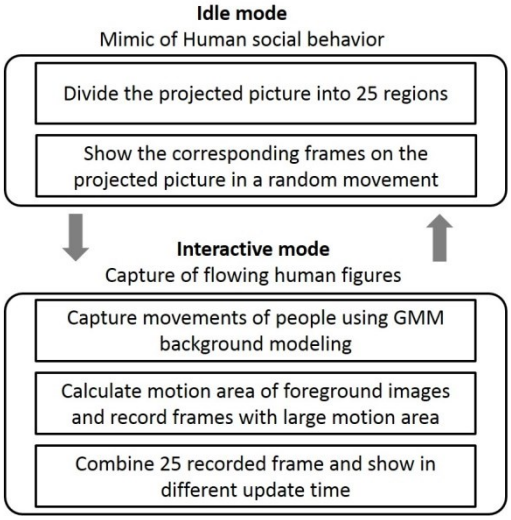


Figure 2: Design phase of the Shadow Calligraphy of Dance.

through body movements. During the interaction, an improvisatorial painting was also been created in a collaborative way when several people who interact with the device (Fig. 1(b)). The implementation of the interactive installation is provided on the video link https://goo.gl/MKtCLz, and the following is the introduction of the artwork.

How to move body to write calligraphy? The relationship between black and white is like Tai Chi, the shadow as the black ink, and the white as the blank area on the painting. The artwork was intent to link the concept of the generating shadow and the black ink, to combine the body movement and the writing calligraphy by image layering, and to create an interactive embodied calligraphy writing. Using image processing technique, the artwork detects body movements of motion figures to show the motion area in black color, and enables the black and white pixels of the image generating the rubbing look as Chinese brush painting. Through the intuitive interactive experience, when users stand in front of the artwork, their figures will turn into the shadow calligraphy of dance.

The rest of the paper is organized as follows. Section 2 presents the design principles of the artwork. Section 3 shows the technology components of the interactive installation. Section 4 concludes the paper.

2 Design Principles

2.1 Idle mode: Biomimicry of human social behavior

In the interactive installation, there are two modes in the design phase: idle mode and interactive mode (Fig. 2). In the artwork, an embedded camera was set on the center of the projected picture, a computer for running the developed program (C++ program language), and a projector for performing the picture in front projection or rear projection. Initially, the interactive installation is in the idle mode. Once it has been triggered, it turns into the interactive mode. After the interaction, it backs to the idle mode that the whole process creates a cycle. In the idle mode, the concept of biomimicry was adopted in the design phase, and performance of the interactive installation aimed to mimic an organic creature with self-conscious. The discipline of *Bionics* addresses an engineering problem in mechanical design that enables machine pretending as an organic creature by mimicking the appearance or behavior of creatures existing in natural world [2]. However, the term may direct to an opposite point, for example, adding robotic mechanism on human body for enhancing the original ability of human. Therefore, the meaning of *Biomimetics* is more close to the main point for creating a machine as elegant and organic as human [2]. *Biomimicry* has become an important issue currently, for not only indicating the mimic of creatures in natural world, but also considering the viewpoint of eco-friendly production [3]. Therefore, the concept of biomimicry was considered in the artwork, and that the behavior of human figures on the projected picture tried to mimic the peek action in real social situation as with strong curious. In addition, the artwork created an eco-friendly production with a virtual layer upon the physical world, and not caused any changes of the physical world. The projected picture combined with 25 human figures in various shapes and face expressions, and the components of the projected picture moved in a random time setting as a small crowd. For generating an intuitive action, each component moves in a short distance on the projected picture as peek action, and 1, 2, or 3 components moved at the same. Hence, in the idle mode, figures on the projected picture mimic human behaviors as with self-thinking.

2.2 Interactive mode: Flowing human figures with place memory

The concept of slow technology was considered in the interactive mode, in which technology aims at refection and moments of mental rest [4]. In the interactive mode, audiences start to participate in the artwork, and the flowing human figures will be preserved during the interaction. In the interactive installation, instead of informing interaction steps to the audience in advance, it was designed for encouraging the audience to discover the trigger mode of the interactive installation. Therefore, the participation of the interactive installation may happen unconsciously for people just passing the building in a hurry, and the projected picture revealing the captured figures as a wall painting plays a role of ambient existence in the city.

The concept of place memory was also considered in the design phase of the interactive mode that the definition of *space* turns into *place* by tagging meanings upon it [5]. People live their daily lives in the city and create a strong connection among them and the city with experiences and memories, for example, impression of a building appearance, a route to work, or a park with self-memories. Usually, most of the traces are ignored, and some of them will be kept in the forms of note, photo or video. By preserving the shapes of people shuttle in the city, the projected picture on the wall as their prints or impressions of the city. Hence, in the interactive mode, the improvisational painting of body calligraphy reveals the connection among people and the city.

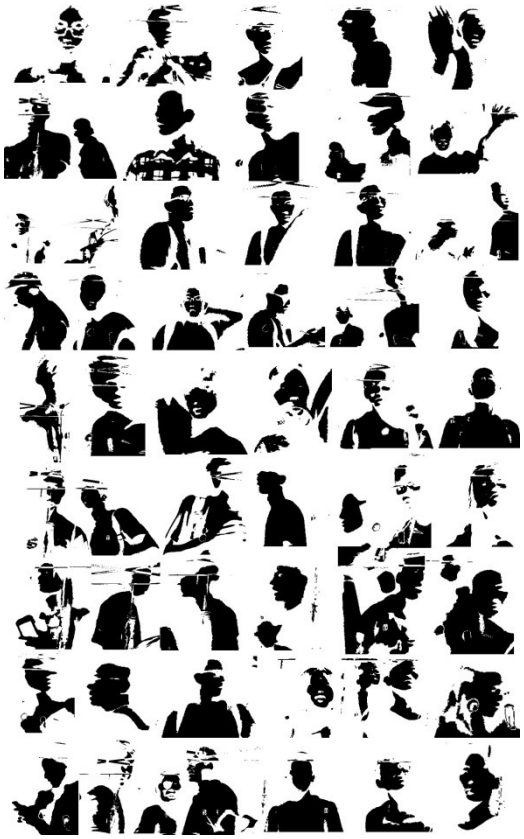


Figure 3: Foreground images with afterimage effect from the recorded data in the outdoor performance.

3 System Description

3.1 Background modeling for creating body calligraphy painting

Background modeling has been used in object detection for detection motion in computer vision field. Through subduction of adjacent frames, motion area on the frames can be divided. In the artwork, GMM model was adopted for measuring motion change, and it enables capturing frames with the composition as body calligraphy painting by adjusting parameters [6]. The speed of decreasing area on the foreground image stream can be controlled by update time setting, and that generates the expected afterimage effect (Fig. 3). The facial expressions of participants were preserved as an abstract painting, and even the detail of cloth texture was captured. The parameter of learning rate on the foreground image stream also influences the amount of face feature information. By adjusting the learning rate, the frame with vivid facial expression that has the property of obvious light and shade distinction can be preserved. In addition, two camera mode were developed in the interactive installation for different light condition: camera mode and depth camera mode (using Microsoft Kinect for Windows v1). In the depth camera mode, the interactive installation can set in a dark environment for ambient capturing movements of people. Hence, in the artwork, a body calligraphy painting with afterimage effect can be implemented through background modeling.

Figure 4: Recorded frames with large motion area.

3.2 Image sequence analysis for creating collaborative improvisation

For performing a body calligraphy painting with aesthetic composition, there are 25 fix regions on the projected picture, and the regions were designed in overlap. In addition, the frames only with small area should be eliminated. Given an image stream, pixels of motion area of each foreground image are calculated, and only the frame with large area is preserved (Fig. 4). The recorded frames are put on the corresponding regions in different update time setting for performing a delayed vision. Only one region in the center of the image plays the current frame in real-time, for arousing audience to notice the connection between their movements and the projected picture. In addition, some of them are reversed in horizontal direction for creating an unpredictable painting with irregular composition. Hence, in the artwork, an improvisational painting of body calligraphy with abundant portraits or body shapes as pop art can be created through image sequence analysis.

4 Conclusions

The interactive installation preserves flowing human figures has been introduced, for creating an improvisational painting of body calligraphy in a collaborative way. In the concept of the artwork, place memory was considered that focuses on the connection between people and the environment. The artwork tried to arouse people to aware their feelings and memories about the city, in which creates an invisible virtual layer upon the physical world. The interactive installation was designed for revealing the virtual layer by preserving and presenting their leaving traces. In the outdoor performance, participants felt excited to find their vivid faces and shapes projecting on the wall. They all had a fantastic experience at the night exhibition and felt more connected to the city they live in.

REFERENCES

[1] Lyn Chao-ling Chen and He-lin Luo, Shadow Calligraphy of Dance, 2017 Nuit Blanche Taipei.
[2] M. H. Dickinson (1999). Bionics: Biological insight into mechanical design. Journal Proceeings of the National Acaddemy of Sciences of the Unites States of America, 96(25), 14208–14209.
[3] E. Lurie-Luke (2014). Product and Technology Innovation. Journal Biotechnology Advances, 32(8), 1494–1505.
[4] L. Hallnäs and J. Redström (2001). Slow Technology–Designing for Reflection. Journal Personal and Ubiquitous Computing, 5(3), 201–212.
[5] T. Cresswell, 2004 Place: a short introduction. Blackwell Publishing, Australia.
[6] C. Stauffer and W. Grimson (1999). Adaptive Background Mixture Models for Real-time Tracking. In proceedings of conference on Computer Vision and Pattern Recognition, 246–252.