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A Study on Image Projection for Augmenting Shirosawa *Kagura* Performance in the Tokutan-jo Spring Festival



Abstract

A lively collaboration between dance performances and video images has been seen in recent years. Such collaboration includes close cooperation between dancers and video artists and projection of images generated automatically in response to a dance. From the latter of these two perspectives, the authors studied video projection intended to augment the appeal of a dance performance. This paper reports on knowledge obtained from use of image projections for *Shirosawa kagura*—the traditional regional performance at the Tokutan Castle Spring Festival in Yahaba, Iwate—with the aim at cultural promotion of local performing arts and evaluations of the image projection by the event organizer and the performer.

Keywords: Image Projection, Augmentation, Traditional Performing Art

1 Introduction

In recent years, video projection techniques, such as projection mapping, have been used to augment various kinds of performances like the performance of Perfume in Cannes Lions International Festival of Creativity [1, 2, 3, 4]. The authors have been studying the interactive effect of image expressions on a performance [5] [6]. In the paper [5], we reported on two kinds of image expressions used to augment street dance performances. Comparing performances that are familiar to young people, such as street dance, we found that they are not very interesting as local traditional performing arts, so there are not enough successors for them. To solve this problem, audience members', including young people's, interest in local performing arts should be increased using digital technology such as image projection to enhance their appeal. In this paper, we report on the effects of using image projections for *Shirosawa kagura*, the traditional regional performance at the Tokutan Castle Spring Festival in Yahaba, Iwate, which aims for cultural promotion of local performing

arts on April 26, 2014. In addition, we provide the results of evaluations of the technique by the event organizer and the performer, as an extended version of the paper [6].

2 Related studies

2.1 Video projection in performances

Although the projection of video images has been used in a number of performances, few papers have been published on the subject. Cases of video projection in performances can be grouped into the following categories.

I. Non-interactive video prepared in advance [7, 8, 9]

II. Interactive video generated in real time

- (A) Video generated using wearable sensors, computers, etc. [10]
- (B) Video generated using noncontact sensors such as cameras [11, 12]

Type I can be used for performances in which dances and

images closely match each other. For example, in the case of “Leptoner” by SHIRO-A [9], repeated practice resulted in a close match between the dance and the music, as well as the video prepared in advance.

Type II (A) is highly interesting in that it employs advanced technology.

In this study, we used equipment capable of analyzing the movements of dancers without having to place sensors on the performers. Thus, the approach aligns with the description for Type II (B).

2.2 Video projection in performances

Like this study, the study by MIT Media Lab [11] employed the method described in II (B). It can be described as a revolutionary study that clearly defined the term “augmented performance.”

In this study, “Dance Space” has been proposed as a system intended to augment dance. *Dance Space* augments performances from the audio and video aspects. As audio augmentation, it is capable of generating sound in response to the dancers’ movements, linking virtual musical instruments to each of the dancers’ body parts. As video augmentation, it draws colored Bézier curves in sync with movements of the dancers, tracing the movements of their body parts and expressing characteristic movements.

This paper describes attempts at various types of augmented expression using advanced technologies. However, the affinity between image expression and individual dance genres such as street dances or local performing arts has not been considered. The authors considered compatibility between three subgenres of street dance and image expressions based on two kinds of concepts for augmenting them in the paper [5]. To acquire more information on augmented performances, we selected a traditional performance—*Shirosawa kagura*, which is different from street dances in its framework and stage equipment—as objects for augmentation. Further, we discussed matching image expressions with the *kagura* performance.

2.3 Traditional performing arts and image projection

Performances combining Japanese traditional performing arts and image projection can be classified as follows.

- I. Projected image includes the performer [13]
- II. Image is projected on the background of the performer [14, 15, 16]

An example of I is “The night in Nanajyo that shows the future of the legend of ‘Fujin Raijin-zu’ by Rinpa in the 21st century, in celebration of the 400th anniversary of Rinpa” [13]. In this case, the video includes the performer and plays the role of the main content of the performance itself. An example of II is “D-K Live: The digital hanging scroll—collaboration with the noh performance [14].” In this case, the images were projected on the warehouse in the background of the noh performer. In this study, we aimed to increase the appeal of the event through the image projection of the interactive video according to the movement of the performer in the background.

3 Process of production

3.1 Objects for image projection

The outline of the event and objects for image projection follows:

I. Tokutan Castle Spring Festival

The Tokutan Castle Spring Festival is held in April each year in the remains of Tokutan Castle. The authors were asked to project image expressions for augmenting the traditional *Shirosawa kagura* performance in the front yard of a traditional house in Iwate (i.e., *nanbumagariya*) by the Education Committee of Yahaba.

II. *Nanbumagariya*

The *nanbumagariya* is an L-shaped house consisting of a main building and a stable; this traditional style house can be seen mainly around Morioka and the Thono basin (Fig. 1). In the remains of Tokutan Castle in Yahaba, Iwate, it can be considered tangible cultural property of Yahaba [17]. The style is characterized by a thatched roof and whitish walls made of mud, exposed black poles and crosspieces.



Fig. 1 *Nanbumagariya* in the remains of Tokutan Castle [18]

III. *Shirosawa kagura*

Shirosawa kagura is an intangible cultural property of Yahaba; it reportedly originated at the base area of Mount Hayachine, Iwate Prefecture, during the Edo era. “Sanbasou” is one of the programs associated with *Shirosawa kagura*; it has more tidal waves than other programs, so it was chosen for augmentation (Fig. 2). An old man wearing a mask resembling a monkey dances in a comical manner, jumping with bells and a fan in his hands.



Fig. 2 *Sanbasou* in *Shirosawa kagura*
(Courtesy of Yahaba’s Education Committee)

3.2 Steps of production

The following steps toward production took four months beginning in December 2013—when we first made contact with the Education Committee of Yahaba—until the festival held on April 26, 2014:

I. Reviewing reference materials from the client

We received reference materials from the client, including a video of the performance, books introducing programs and costumes, a sketch and photo of the actual venue, and so on. There was little detail about the program available in books and on the Internet.

II. Visit to actual venue

We visited the barnyard of the *nanbumagariya*, inspected the area, and conducted simplified test projections with the *magariya*. At this time, there was snow on the roof, so we could not project in the same conditions as the day of the event.

III. Designing concepts (1)

After studying the client's reference materials, books, and information on the Internet, we developed a concept regarding the kinds of videos best suited for the festival, performance, and venue. Yahaba's Education Committee gave their request seeing the sample movie we had made before. For this step, we shared video images using rough sketches with members of the team.

IV. Development of system

We developed a system for producing video images based on the concept we designed in step III.

V. Test Projection

We checked to see what the projected video generated by the system looked like in conditions like those that were expected on the day of the event at the actual performance site after the snow had melted.

VI. Designing concepts (2)

Based on the results of Step V, we improved the concept developed in Step III.

VII. Rehearsal

Joining the *kagura* performer and the band, we checked how Kinect detected performers' movements and how the video looked. As the same time, we checked to see what kinds of problem might occur on the day of the event.

VIII. Improvement of the system

Based on the result of step VI, we improved the system to solve the problem. Additionally, to improve the system structure for the performance, we added equipment such as lights.

IX. Preparation on the day of the event

We started preparation in the evening in for the event, which was going to be held at night. Because other events were not being held at the same place, we had sufficient time to prepare.

4 Concepts

Considering the objects for projection—*nanbumagariya* and *Shirosawa kagura*—we believed that video augmentation reflecting Japanese-inspired moods would be suited to them. There are many flowing movements in *kagura*, so we decided to add the movements of fluids, such as water and air. The three types of image expressions that we created are described below (Fig. 3).

I. *Hana Ikada*

Hana Ikada refers to scenery in which fallen petals flow on water (like a raft); the concept originated in ancient Japan. It is a seasonal term associated with spring, suggesting the melancholy feeling that is associated with the end of the season. We believed that the motif would correspond nicely with the spring festival and the flowing movements of *kagura*. In the corresponding image expression that we created, petals of cherry blossoms flow to trace the performer's movements.

II. *Suminagashi*

Suminagashi is a traditional Japanese artistic technique in which letters or patterns are drawn with ink or pigmented water and drafted onto paper.

In the image expression we created, silhouettes of performers flow on water like ink in *Suminagashi*.

III. Beacon

Beacons are sometimes used as illumination for *kagura* performances at night. We believed that a flame swaying in the wind fit well with the flowing movements of *kagura*.

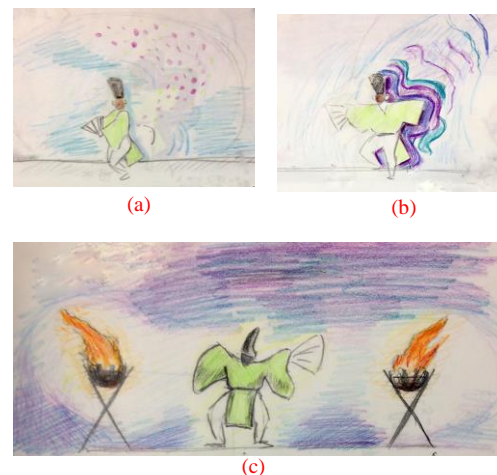


Fig. 3 Rough sketches from the designing concepts step
(a) *Hana Ikada*, (b) *suminagashi*, and (c) Beacon

Regarding the projection of video images, we did not wish to destroy the moods inherent in the *kagura* performance, so we decided not to project video directly on the performer. Instead, we projected images on the roof and walls of the *nanbumagariya*.

5 System structure

Figure 4 shows the system structure. We used two computers, one for generating videos in real time (*Suminagashi*), and the other for *Hana Ikada* and beacon images. Because of remitted electrical energy in the actual performance venue, the number of computers we could use was remitted as well. Therefore, for *Hana Ikada* and the beacon, we used video generated with the system and captured images beforehand, essentially combining two types of videos using video editing software (Fig. 5).

Figure 6 shows the layout of equipment. We arranged four projectors for projecting four aspects in total; specifically, each projected one aspect of the roof and walls. Because of projections from oblique directions, we used free software—Video Projection Tool (VPT)—for correction of deformation of the video (Fig. 7). Two Kinects were arranged to the right and left sides of the performer. Thus, even if one of the two could not detect the bones of the performer, another Kinect would ensure that generation of video images continued.

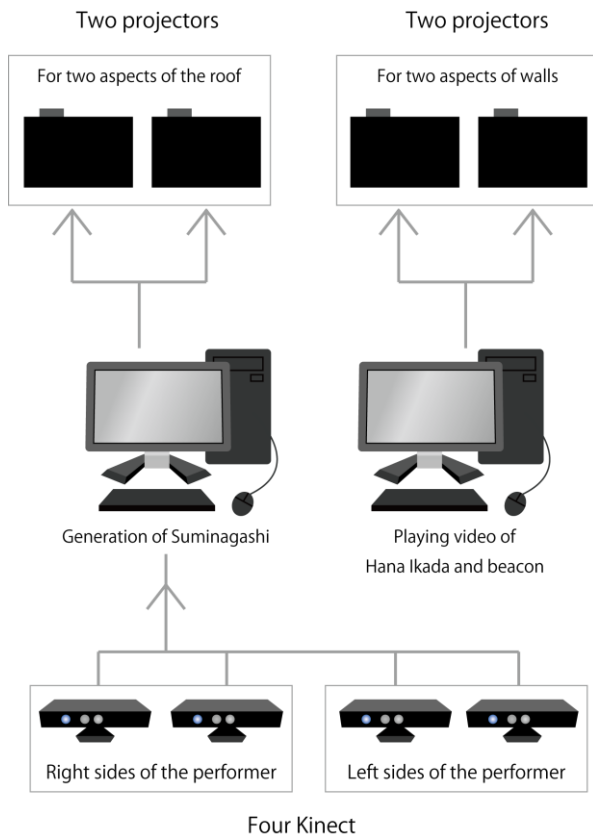


Fig. 4 System Structure

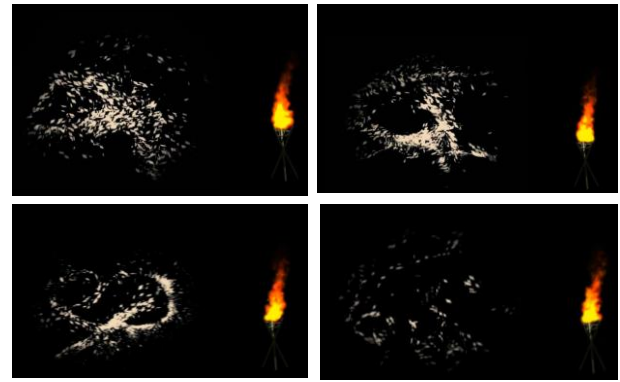


Fig. 5 Video of *Hana Ikada* and beacon

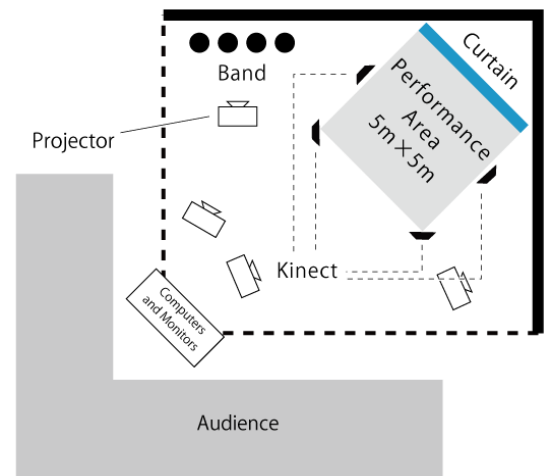


Fig. 6 Layout of equipment

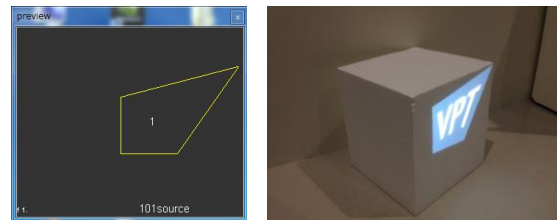


Fig. 7 Correcting deformation of the video using VPT (Left: interface of the soft, right: correcting the projected video)

6 Video generations

For expressing fluid, we adopted a method in which the space where fluids move can be conveyed by using a vector field called the velocity field by Jos Stam [19]. By floating silhouettes or diamond-shaped plains on the field, these objects seem to move with fluidity.

In this study, we added a function to the velocity field so that it could interact with handling of users (Fig. 8). Handling of users refers to the amount of change in a performer's bone detected by Kinect or from a keyboard. When a performer moves his/her arms or a user inputs data from a keyboard, noise is added to the velocity field and the direction in which fluid flows will change. Therefore, we were able to connect a performer's movements with fluid movements.

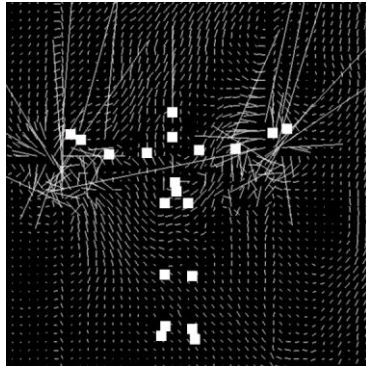


Fig. 8 Changes in velocity field from movement of bones

7 Experiments

7.1 Visiting the actual venue

During our first visit, we investigated the environment and conducted simplified test projections. When we visited initially, there was snow on the roof, so we could not test how the video would be seen under the same conditions as on the anticipated day of the event. However, we projected sample videos made beforehand on the roof and the walls from our laptop PC. The roof was white because of the snow, so we did not have any problems projecting the video images in their natural color. We acknowledged the possibility that there could be problems projecting images directly onto the roof's surface on the day of the event because of its black color. The walls were whitish, so we did not encounter problems projecting onto them in the natural color of the video images.

7.2 Test projection

In this experiment, we projected onto the roof after the snow had melted to check the characteristics of the surface.

We believed that the video, with its high-brightness, would be suited for projection onto the roof. There were two reasons for our hypothesis. First, the *nanbumagariya* has a thatched roof, which has become black over many years. Second, by projecting from oblique directions, the projected surface would not reflect as much on the audience and would blend in with the blackish color of the roof; thus, an image would not be seen clearly without sufficient brightness. Regarding the texture of the roof, it was an uneven surface consisting of cut thatch. The video with many small objects was difficult to see clearly although it can be seen without problem in the case of projection to smooth surface. We found that video images in a single color could be seen more clearly than those with many small objects on the uneven surface.

7.3 Rehearsal

As preparation for the actual performance, we conducted test projections to detect performer's movements by Kinect (Fig. 9). In this experiment, it was problematic that the silhouette generated on the video became smaller and seemed less impactful when the performer moved away from the Kinect.

To solve the problem, we decided to add the function to ensure that the size of the silhouette could be adjusted based on the distance of the performer from the Kinect to the system. For projection, the space was dark and the performer could not see the details of the space in which she was performing, so she requested that we provide illumination on the day of the event.

The local paper, the *Morioka Times*, conducted an interview during this rehearsal, and it introduced the intentions of Yahaba's Education Committee and the preservation association of *Shirosawa kagura* [20]. The president of the preservation association of *Shirosawa kagura* said, "In folk performing arts, we are facing the problem that we do not have many successors. So we hope that young people will pay attention to this innovative performance."

A representative for Yahaba's Education Committee commented, "We intended to show an innovative performance for the future of folk performing arts. We would like audiences to feel the innovative form and possibility of cultural properties."



Fig. 9 Test projection at the rehearsal

8 Results

We participated in the performance in front of a live audience at the Tokutan Castle Spring Festival on April 26, 2014. We began our preparations for the performance during the day (Fig. 10). There were a lot of people in the audience (Fig. 11) for the performance that lasted 10 minutes (Fig. 12).



Fig. 10 Preparation before the performance



Fig. 11 Audience at the performance



Fig. 12 Performance at Tokutan Castle Spring Festival
(Courtesy of the Yahaba's Education Committee)

The performance at the Tokutan Castle Spring Festival has been introduced on YouTube as a video recording [21]. It was reported in Yahaba's newsletter [22] (Fig. 13). In the newsletter, the performance was reviewed as follows: "Movement of *kagura* performed in front of the *nanbumagariya* was projected on the roof of it. The area surrounding *magariya* was filled with fantastic moods."



Fig. 13 Article introducing the festival in *Kouhou Yahaba*

9 Discussions

After the event, we asked for evaluations of the performance from Yahaba's Education Committee as the organizer of the event and from the preservation association of *Shirosawa kagura*. Additionally, we asked people who watched the video recording of the performance to evaluate it via a questionnaire. The results follow.

Feedback from Yahaba's Education Committee as the organizer of the event

- Compared to the festival last year (2013), the size of the audience doubled roughly from 200 to 400 people. Good weather and the performance itself were probable factors for the increase. They were able to retain a sizable audience for the nighttime event because of the performance. Many people appreciated the cultural properties.
- The moods created by the beacon and shower of cherry blossoms seemed to be suited to the meaning of *kagura*; the performance was augmented by more than ordinary performances.
- Audience members over age 40 gave mostly positive feedback, but children and people under age 30 seemed to feel that the performance was a bit unsophisticated. The younger audience might have had the preconceived idea that performance should dazzle visually with lights

or dynamically moving rays.

- They want people to understand that folk performing arts are traditional performances that have not changed significantly over time, but they recognize that audiences get bored with these traditional models. To solve the problem, it may be effective to show two types of performances during an event. For example, an innovative one could be performed at the beginning, and a traditional one could be performed later.

Discussion regarding feedback from the organizer

We believe that video projection was effective because it contributed to an increased audience size and augmented the traditional performance innovatively. Regarding showing two types of performances (traditional and innovative), we believe that this approach could be effective by introducing the element of surprise and emphasizing for the audience the differences between an augmented performance and a traditional one. In other words, the content of a program would not change, but a shift from no augmentation to augmentation in the middle of the program would be impactful.

Feedback from the preservation association of *Shirosawa kagura*

- The video projected on the walls was light and the resulting mood seemed to match the meaning of *kagura*, which is performed to entertain gods.
- The video of *Suminagashi* projected on the roof was both subtle and profound, but it seemed more in line with a *noh* performance that deals with ghosts than with *kagura*, which deals with gods.
- They hope video projection will continue to increase audience sizes, although they recognize that people who like traditional performing arts appreciate the traditional models. Therefore, if the visual effect is overdone, it may not be acceptable for those people. They seek to match the video effect to the moods of *kagura* and the emotions in Japanese style.

Discussion considering the feedback from the preservation association of *Shirosawa kagura*

We found that the video pattern of *Suminagashi* did not necessarily match the meaning of *kagura*, depending on the program type. It seems that more effort is needed to promote understanding about the meaning of *kagura*; thus, it is not particularly effective to lump many traditional performances together as a “Japanese one.” Regarding the “subtle and profound” moods created by the video, we believe that the

white color of video images made such moods. If we can bring in equipment that can project in greater brightness than the projectors we used, the colors would be more vivid and the images would evoke happier feelings; thus, we could achieve a mood more suited to the meaning of *kagura*’s programs. As to the expectation that video projection may trigger greater interest in traditional performing arts, we believe that this assumption has been supported by the increased audience size for the 2014 performance.

Feedback from viewers who watched the video recording of the performance

To gather feedback for “collaboration between traditional performing arts and technology,” we conducted a survey using a questionnaire, and we played the video recording of the event at Art & Technology Tohoku 2014 (a contest held by The Society for Art and Science -Tohoku Section) [23]. Regarding the question asked of participants (Fig. 14), there were five possible answers on a scale of 1 to 5, with 5 as the most positive. Of the 14 respondents, one evaluated the performance with a rating of 3; six people assessed it with 4, and seven people evaluated it with 5 (Fig. 15). Clearly, the feedback was overwhelmingly positive.

Q. What do you think about this performance that fuses traditional building and performing arts and modern technology?

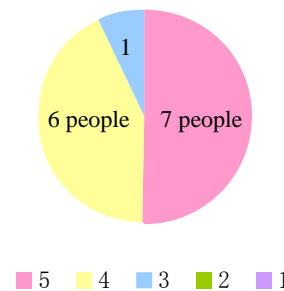


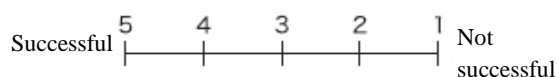
Fig. 15 Survey results from Art & Technology 2014

10 Conclusions

Our initial effort to augment a performance at the designated event with video images contributed to increasing the size of the audience. Regarding the issue of making young people more interested in local performing arts, we found that they had the preconceived idea that a performance should dazzle one visually, so the actual event seemed a bit unsophisticated to them comparing to the image they had in mind. Therefore, in future projects, we believe that discussing what kinds of video can make a performance more impactful without

4. What do you think about this performance that fuses traditional building and performing arts and modern technology?

Please mark your answer on the scale of 1 to 5, and write the reason for your assessment.



The reason

Fig. 14 Actual question on the questionnaire

disturbing the atmosphere of *Kagura* can lead to more people having interest in the *Kagura* performance.

For affinity between *Kagura* and images, by projecting three types of videos, we learned that the brightest one was best suited to the meaning of *kagura* (to entertain gods). As a future project, we intend to demonstrate a greater understanding of traditional performing arts by creating videos that can match each program. Further, we would like to extend the variety of video expressions by not only using methods for fluidity but also by introducing other simulation methods to match a variety of performances and video projections.

Acknowledgements

We would like to thank Yahaba's Education Committee. Without their proposal and cooperation, our joint performance with *Kagura* would not have been possible. We also would like to thank Prof. Kenta Motomura for his continuous encouragement; and Mr. Norihiro Nasukawa, Mr. Shuhei Owada, and Mr. Ryota Kojima for their help to the practice of image projection.

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