A System for Practicing Formations in Dance Performance Using a Two-Axis Movable Electric Curtain Track

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ABSTRACT
Improving physical expressions and the sense of rhythm in dance performances has become important in recent years due to the increase in child dancers and dance studios. Even beginners in dance gain more opportunities to perform dances in groups. When dancing in a group, collapsed formation will greatly reduce the quality of dance performance even if the choreography is synchronized with the music. Therefore, learning the dance formation in a group is as important as learning its choreography. It is also important to be aware of keeping the proper formation and moving smoothly into the next formation to perform professional level group dances. However, it is difficult to obtain the sense of a proper formation if some members of the dance cannot participate in the practice. We have proposed a practice-support system for performing the formation smoothly using a self-propelled screen even if there is no dance partner. However, the movement of people was limited more than necessary by the excessive presence of a self-propelled screen moving irregular and the fear of the collision with the screen. Therefore, the reproducibility of the trajectory in the case where the user danced with another dancer was low. In this work, we propose a practice-support system for performing the formation using the two-axis movable curtain rail, whose movement direction does not drift and the material used for projection is soft. These characteristics reduce the fear of the collision and improve the accuracy in movement of the screen.

Author Keywords
Formation dance training; Electric curtain track; Projector;

ACM Classification Keywords
H.1.2 MODELS AND PRINCIPLES: Human factors Human information processing Software Psychology

INTRODUCTION
It is important to be aware of keeping the proper formation and moving smoothly into the next formation to perform professional level group dances. However, it is difficult to obtain the sense of a proper formation if some members of the dance cannot participate in practice. There have been various approaches to support learning the dance performance. For example, there were methods of learning skills using motion capture technology[2] and inertial sensors. However, to our knowledge, there is no work focusing on training formations. We proposed a practice-support system for performing the formation smoothly using a self-propelled screen[1] even if there is no dance partner. However, the movement of people was limited more than necessary by the excessive presence of a self-propelled screen moving irregular and the fear of the collision with the screen. Therefore, the reproducibility of the position when you dance with a dancer was low. In this work, we propose a practice-support system for performing the formation using the two-axis movable curtain rail, whose movement direction does not drift and the material used for projection is soft. These characteristics reduce the fear of the collision and improve the accuracy in movement of the screen.

SYSTEM DESIGN
Figure 1 shows a system image. Two curtain rails are attached to the ceiling in parallel. Another curtain rail is suspended perpendicular to them.
The proposed approach has some advantages. Since the movement of curtains is limited on the curtain rails, it is able to be suppressed the irregular motion. Moreover, the fear of injury is able to be reduced in the event of a collision because it does not require a frame for fixing a screen for hanging the screen from above. Furthermore, we are able to practice as passing each other within the distance to the curtain closer than the distance to the self-propelled robot because it does not require the self-propelled robot and a large frame around legs running on the floor. Additionally, there is a possibility that the curtains can move faster than the robots because the curtains are very light and high-power motors can be installed on the curtain rails. However, the proposed approach has some disadvantages. The size of mechanism becomes larger than it of the self-propelled screen because of some reasons including the limitation that the curtain must be attached to the ceiling. In addition, It is difficult to use multiple curtains at the same time. For these reasons, a two-axis movable electric curtain track is not only able to solve the problem of the self-propelled screen though it is difficult to use multiple curtains at the same time.

IMPLEMENTATION

There is a photographer of the system being used in Figure 2 shows a snapshot of a prototype of proposed system. We used a electric curtain track(TV24, NAVIO), whose rotating parts has been modified with respect to the lateral movement. We replaced the attached gear with a stronger gear to get more speed. For the movement in the front-back direction, a electric curtain track itself moves by attaching vertically two curtain rails on both ends of a curtain rail used in the case of lateral movement. At present, the movement in the front-back direction is possible if only manual. In the future, we automate the movement in the front-back direction by attaching a motor similar to the mechanism of the lateral movement. The screen has a net curtain to prevent the wind resistance.

### EXPERIMENT ON A CURTAIN

We investigated whether a sense of presence provided by some methods of practicing formations was close to the sense we really obtain when we dance with humans. The subjects were three dancers who had experience dancing for more than three years. They learned two simple choreographies of approximately 8 seconds that consisted of two times eight beats after checking the reference video. The subjects in Experiment 1 danced alone. The subjects in Experiment 2 danced with a self-propelled robot controlled wireless. The subjects in Experiment 3 danced with the video of a dancer projected onto the wall at the back of a subject through the mirror. The subjects in Experiment 4 danced with the self-propelled screen while the video of the dancer is projected to the screen. The subjects in Experiment 5 danced with a movable curtain that is our proposed system. All subjects danced the two types of the two times eight beats choreography for 36 times in total, 3 times each for experiments 1, 2, 3, 4, 5 and dancing with a dancer. We recorded the trajectory obtained from a depth camera (Microsoft Kinect). All subjects evaluated each methods in 5 stages.

Table 1 shows the results of the questionnaire and Table 2 summarized the average and the standard deviation of distance. In Table 2, smaller distance means that high similarity to the movement in the case of dancing with a human. The results of the questionnaire shows that dancing with a curtain in terms of human feelings was close to the feelings dancing with a dancer. However, The results of the average and the standard deviation of distance shows that the movement of dancing with a curtain cannot reproduce the movement of dancing with a dancer.

### CONCLUSION

We have proposed a two-axis movable electric curtain track and discussed the advantages of the proposed system. In the future, we will improve our system, do experiments with a long complex choreography and investigate the effects of our system. Furthermore, we investigate what kind of support is effective to enable the formation to be practiced.

### REFERENCES