The effects of the presence of an audience on the emotions and movements of dancers

Nao Shikanai\textsuperscript{a, *}, Kozaburo Hachimura\textsuperscript{b}

\textsuperscript{a}Japan Women’s University, 2-8-1, Mejirodai, Bunkyo, Tokyo 112-8681, Japan
\textsuperscript{b}Ritsumeikan University, 1-1-1, Nojihigashi, Kusatsu, Shiga 525-8577, Japan

Abstract

To examine effects of an audience on dancers, we analyzed differences in dancers’ emotions and body movements in the presence and absence of an audience. We evaluated their emotions using the Positive and Negative Affect Schedule and analyzed their movements through motion capture. Dancers’ scores for both positive and negative emotions increased in the presence of an audience. The maximum acceleration in hip movements differed depending on whether an audience was present, and the correlation between positive emotions and the acceleration tended to be positively high. These results indicated the presence of an audience affected dancers’ emotions and dance movements.

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1. Introduction

In the performing arts, such as entertainment and music performance, a dynamic interaction occurs between the performers and their audiences at the moment of generating great enjoyment. While performers make an influence on their audience, they are also influenced by their audience \cite{1}\cite{2}\cite{3}. In addition, the performer tries to amuse the audience and, conversely, the audience wants to enjoy the performance. Consequently, a good relationship will be

* Corresponding author. Tel.: +81-3-5981-3727; fax: +81-3-5981-3728.
E-mail address: shikanain@fc.jwu.ac.jp
established between the two parties and enjoyment will be shared. This sharing establishes a close communication between the performer and the audience [4].

One of the major functions of dance is to make communications with others [5]. In dance, a bi-directional relationship to see and to be seen exists between the dancer and the audience. In this relationship, the consciousness and actions of the dancer and audience are changing in each moment. However, previous studies on dance by using motion capture [6][7][8] and by observers' evaluations [9][10] have taken almost no account of the actual environment of the dance performance. Analyses of dance that focus on quantitatively analyzing the effects of the presence of an audience on the dancers have thus far been limited. Simply conducting an analysis of dancer-based emotion and movements cannot fully explain the process of communication in dance.

Previous studies focusing on the relationship of emotion and performance of sports reported that the emotions change depending on the presence of others and the environment (e.g., before and after the game, or between the rehearsal and real stage). Especially, about emotional change, the results show that individuals become nervous and jittery, or feel distressed [11][12]. However, dance is different in that it does not simply involve getting nervous while the audience is watching a performance, and it is not always about winning or losing as in sports. Accordingly, dancers are expected not only to have negative emotions but also positive emotions while dancing, such as being nervous and excited, or nervous and inspired.

2. Methods

2.1. Dancers and audience

Six male dancers participated to performance. Three of the dancers A, B, and C, were skilled dancers with an average of 5.2 years of experience in various forms of dance. The remaining three dancers D, E, and F, were less experienced with an average of 1.5 years of experience in hip-hop dance forms.

Fifteen observers participated as members of the audience in each dance experiment.

2.2. Procedure of dance recordings

The dancers performed the step movements in street dance forms, which are a form of basic dance exercise and a fundamental training method for helping dancers get a sense of rhythm. The dancers performed 8 counts of these movements twice in a task. Each dancer performed the task three times, both in the presence of an audience (dancer with audience condition) and in the absence of one (dancer only condition). All dancers performed under the both conditions. Each dancer stood facing the audience, at a distance of 1.5 – 2 meters during dance performances. The audience sat on the floor and watched the dance performance. The audience was allowed to clap their hands and to move their bodies to the rhythm during watching the dance performance. Aside from the dancers, 2 experimenters were present in the experiment room during recordings in the dancer only condition.

2.3. Apparatus

The motion capture system (Motion Analysis Corporation, California) with 10 cameras was used to capture and record the dances. The sampling rate was 60 Hz. A total of 32 reflective markers were attached to the body of each dancer. The capture volume was set up 3.0 m × 3.0 m.

In addition, we acquired motion data in the TRC format constructing the three-dimensional coordinate values in EvaRT software (Motion Analysis Corporation, California) with the motion capture system. Data on each marker position in each frame were acquired in a time series of coordinate values (x, y, z).

2.4. Evaluation of dancers’ emotions

To evaluate dancers’ emotions in this research, the Japanese version of the PANAS (Positive and Negative Affect Schedule) [13] was used. This scale divided emotions into two types, positive and negative. Positive emotion was assessed through 8 items addressing the following: being active, proud, strong, inspired, determined, excited, alert,
and enthusiastic. Negative emotion was also constructed by 8 items addressing the following: being irritable, scared, upset, afraid, distressed, nervous, ashamed, and jittery.

After each condition, dancers rated their emotions to each item on a 6-point scale ranging from 1 (not at all) to 6 (extremely).

3. Results and discussion

3.1. Emotions of dancers

We calculated every dancer’s mean positive emotion score in each condition, and compared these using a $t$-test. The results are shown in Figure 1 on the left-hand side. The scores obtained by Dancers A, B, D, E, and F were significantly higher in the dancer with audience condition than in the dancer only condition; however, no significant difference was observed in Dancer C’s scores in the two conditions [A: $t(2) = 15.59$, $p < .01$; B: $t(2) = 1.11$, $p < .05$; C: $t(2) = 0.55$, n.s.; D: $t(2) = 13.00$, $p < .01$; E: $t(2) = 19.05$, $p < .01$; F: $t(2) = 32.00$, $p < .01$]. Although Dancer C’s scores on positive emotions remained relatively unchanged regardless of whether an audience was present, the dancer’s scores were higher when compared to those of the other dancers when an audience was present.

Next, we calculated the mean negative emotion score of every dancer in each condition, and compared these with a $t$-test. The results are shown in Figure 1, on the right-hand side. The scores of Dancers A, B, D, and E were significantly higher when an audience was present as compared to when one was not. In addition, the score was notably higher for Dancer E (by 24 points) in the presence of an audience. However, there were no significant differences in the scores of Dancer C and F in both the conditions [A: $t(2) = 12.12$, $p < .01$; B: $t(2) = 12.12$, $p < .01$; C: $t(2) = 3.05$, n.s.; D: $t(4) = 27.58$, $p < .01$; E: $t(2) = 34.64$, $p < .01$; F: $t(2) = 3.00$, n.s.]. The results showed that although negative emotions were higher when an audience was present, they were lower as compared to the positive emotions.

Previous studies [11][12][14] have shown that negative emotions, such as extreme anxiety or tension are often aroused in sports when players feel the pressure in a live game. However, while it needs additional consideration of individual differences and skill levels, both positive and negative emotions are aroused during a dance performance. This may be the reason why the dancers had comforting rhythm of rising and easing tensions during their performances. It is considered that the dancers were first nervous due to the presence of audience, but gradually had fun and were more exited, and then tried to communicate with the audience during dance. Dance is based strongly on a good performance, but it is not aimed to winning like other sports. Further, the dancers’ communication with the audience’s aid better performance. Accordingly, it may have been possible that the dancers were trying to enjoy with the audience, to the maximum extent possible.
3.2. Movement characteristics of dancers: Maximum trunk acceleration

To examine how dancers differed in their movements in the presence and absence of an audience, we first calculated their body movement characteristics from the recorded motion data. In addition, we focused on their trunk movements involving their right shoulder, left shoulder, chest, and hips, which are considered essential in dance. We expected dancers to exhibit varying levels of strength exerted in these movements. Accordingly, we measured their speed, acceleration, and maximum acceleration.

After every dancer’s maximum acceleration was determined, we calculated the mean maximum acceleration for each body part in each condition, and compared these using a t-test (Table 1). There was no significant difference in the maximum acceleration of the right shoulder, left shoulder, or chest during both the conditions [right shoulder: $t(10) = 0.27$, n.s.; left shoulder: $t(10) = 0.28$, n.s.; chest: $t(10) = 0.07$, n.s.]. However, maximum hip (combination of the right hip and left hip) acceleration was significantly greater in the presence of an audience, rather than in its absence [$t(10) = 0.88$, $p < .05$].

The mean maximum acceleration of the hips was higher in the presence of an audience than in its absence. It makes it easy for dancers to move and accent their limbs, and for an audience to follow and observe them. However, other than the differences in their limb we observed differences in movements of their hips, which are generally difficult to coordinate and move. Greater acceleration is considered indicative of accented or dynamic movement [6][8]. While this research focused on the step movements in street dance forms, we observed an increase in dynamic hip movements in the presence of an audience.

| Acceleration (cm/s²) | Presence | Absence |
|----------------------|----------|---------|
|                      | Mean (SD)| Mean (SD) | $p$ |
| Right shoulder       | 15.53 (4.28) | 14.86 (4.21) | n.s. |
| Left shoulder        | 15.29 (3.44) | 14.70 (3.79) | n.s. |
| Chest                | 14.97 (4.17) | 15.12 (3.21) | n.s. |
| Hip                  | 12.70 (1.99) | 11.78 (1.61) | * |

3.3. Correlation between emotions and hip acceleration

The findings in Section 3.2 showed that the mean maximum acceleration in hip movements differed according to the presence or absence of an audience. Additionally, we analyzed the relationship between emotions and hip acceleration. We calculated correlations between the dancers’ emotion scores on the PANAS and the mean maximum acceleration scores of their hips in the presence and absence of an audience (Table 2).

In the presence of an audience, positive emotions were found to have a mid-level positive correlation to the mean maximum hip acceleration. On the other hand, the correlation between the negative emotions and mean maximum hip acceleration was negatively low. In the absence of an audience, the correlation between positive emotions and mean maximum hip acceleration was positively low. However, these correlations were not significant within the 5% level of significance, and need to be interpreted as the correlation of this sample alone.

The results indicate that the dancers in the present experiment exhibited greater mean maximum hip acceleration with higher arousal of positive emotions in the presence of an audience. Similarly, when the arousal of negative emotions is higher, mean maximum hip acceleration is lower. Combined with the results presented in Section 3.2, it can be conjectured that with higher arousal of positive emotions in the presence of an audience, dynamic hip movements can be observed, especially with reference to step movements in street dance forms.
4. Conclusion

To investigate the effects of an audience on the psychological state and movements of dancers, we examined how they differ while performing under two conditions: with and without the presence of an audience. Evaluation of the dancers’ emotions with the PANAS revealed that both positive and negative emotions increased in the presence of an audience. In other words, dancers’ psychological states changed when an audience was present. Furthermore, focusing on their trunk movements, we confirmed that there was a difference in the maximum acceleration depending on whether an audience was present during the performance. Mean maximum acceleration of the hip was greater during performances when an audience was present. Finally, we examined relationships between the emotions and the maximum hip acceleration. Therefore, the presence of an audience was found to have considerable influence on dancers’ emotions and body movements.

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References

[1] Ikegami S, Shigeno S. Relationship between reaction of audience and appreciation of musical performances. The AGU Journal of Psychology 2009; 9, p.1-9.
[2] Nomura R, Maruno S. Effects of narrative strategies by using Rakugo performers on fun [Rakugo no enja ga mochiiru katari no houyyaku ga omoshiro na ni ateru eikyo]. The Japan Society for Laughter and Humour Studies 2006; 13, p.13-23.
[3] Yamamoto T, Miyake Y. Analysis of musical communication between players in a musical cooperative performance. Transactions of the Society of Instrument and Control Engineers 2004; 40, 5, p.563-572.
[4] Nomura R, Maruno S. Exploring a relational system between a performer and audience in Vaudeville Humor Elicitation Process. Cognitive Studies 2007; 14, 4, p.494-508.
[5] H’ Doubler M.N. Dance: A creative art experience. Madison, WI: The University of Wisconsin Press; 1998.
[6] Sakata M, Hachimura K. KANSEI information processing of human body movement. Lecture Notes in Computer Science 2007; 4557, p.930-939.
[7] Choi W, Isaka T, Sekiguchi H, Hachimura K. Quantitative analysis of leg movement and EMG signal in expert Japanese traditional dancer. Advances in Human-Robot Interaction 2009; p.165-178.
[8] Sawada M, Suda K, Ishii M. Expression of emotions in dance: Relation between arm movement characteristics and emotion. Perceptual and Motor Skills 2003; p.697-708.
[9] Shikanai N, Sawada M, Ishii M. Development of the movements impressions emotions model: Evaluation of movements and impressions related to the perception of emotions in dance. Journal of Nonverbal Behavior 2013; 37,2, p.107-121.
[10] Shikanai N, Hachimura K. Comparison of Kansei information between joyful and happy expressions in dance. Lecture Notes in Computer Science. 2013; 8004, p.611-619.
[11] Cerin E. Anxiety versus fundamental emotions as predictors of perceived functionality of pre-competitive emotional states, treat, and challenge in individual sports. Journal of Applied Sport Psychology 2003; 15, p.223-238.
[12] Tanaka Y, Sekiya H. Relationship between positive-negative affect and performance in a golf competition. Studies in Human Sciences 2007; 2, p.93-99.
[13] Sato A, Yasuda A. Development of the Japanese version of Positive and Negative Affect Schedule (PANAS). The Japanese Journal of Personality 2001; 9, p.138-139.
[14] Ishii M, Kusumoto Y, Mieko A, editors. The usefulness of sports psychology in the field [Genba de ikiru spotsu shirigakuj]. Tokyo: Kyorin-Shoin; 2012.