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THE RELATION BETWEEN EMOTIONAL VALENCE AND PERFORMANCE MOTION OF THE KEYBOARD INSTRUMENT

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Abstract

This study examined relations of the emotion and part of the upper body during the keyboard instrument performance. The study showed the trace from the lateral direction to watch movement. As a result, there was a difference in the emotional expression of the performance in the head and upper arm. In this way, we understood that the part except the hand was important to emotional expression in the keyboard instrument performance. The future investigation is going to analyze the front.

Keywords: emotion, motion capture, keyboard instrument

1. Introduction

Emotional expression is important to performance of the music. Thompson's study measured the piano performance using an optical motion capture (Thompson, 2012). The study examined four different performance conditions. Expressive intention is drawing attention, like in this study.

Davidson found that head movement is important for observers to discriminate between pianist's performances with different expressive intentions (Davidson, 1994). Castellano examined emotion and motion by the pianists using the video. The results showed that both were sensitive to emotional expression, especially the velocity of head movements (Castello, 2008).In this way, there is the study that mentions the importance of the part of the body.

This study examined relations of the emotion and part of the upper body during the keyboard instrument performance.

2. Experiment

2.1. Subject

We measured a keyboard performance in the classroom of the university. The player was one professional pianist. The keyboard was CASIO CTK-810.

2.2. Experiment summary

The performance task used simple music for the beginners. We showed a performance task in Figure 1. The key is C major. He performed by expressing emotion of five emotion (happiness, tenderness, anger, sadness, fear) used Juslin (Juslin, 2001) and emotionless for a task. After hearing four beats of sound, we requested to perform by the M.M. = 90. He performed the same melody on the both hands.

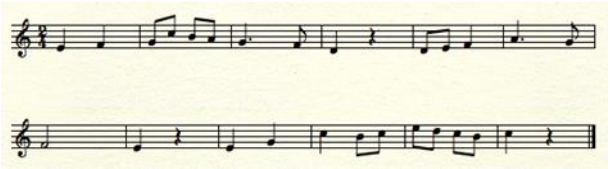

Figure 1. Performance task

2.3. Environment of the measurement

In motion capture, reflective markers are attached to a person's upper body and multiple infrared cameras are used to detect the positions of these markers in three-dimensional space. These positions are output as a temporal series of absolute spatial coordinate values. The experimental apparatus was configured using a Motion Analysis MAC3D motion capture system with 6 Raptor-H cameras (frame rate 100 fps, shutter speed 1/2000 s). We used a total of 34 markers in the upper body and keyboard instrument (Figure 2).

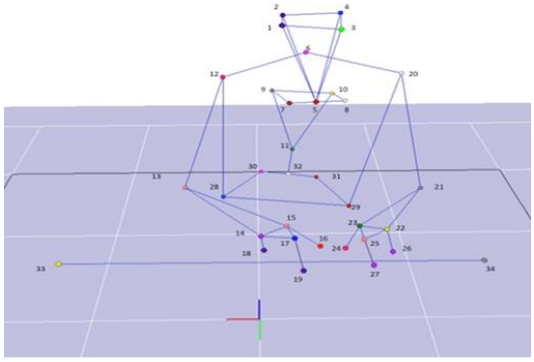

Figure 2. Marker adhesion position

2.4. Analytical approach

The analysis section was from the beginning of the first sound to the last sound. To investigate how pianist moves the upper body, we calculated their center of gravity. This was calculated by modeling the upper body as a collection of 8 parts (head, torso, upper arms, forearms, hands), using the center of gravity position of each part Pgi(xg(i), yg(i), zg(i)) (i = 1, 2, …, 8), the mass center ratio m(i) and the position data of each part of the body obtained from the motion capture data. The center of gravity position Pgi(xg(i), yg(i), zg(i)) of each body part is calculated using Eq. (1). Here, the positions Psi(xs(i), ys(i), zs(i)) are the start positions of each body part, and the positions Pei(xe(i), ye(i), ze(i)) are the end positions of each body part.

$$\begin{bmatrix} x_g(i) \\ y_g(i) \\ z_g(i) \end{bmatrix} = (1-m(i)) \begin{bmatrix} x_s(i) \\ y_s(i) \\ z_s(i) \end{bmatrix} + m(i) \begin{bmatrix} x_e(i) \\ y_e(i) \\ z_e(i) \end{bmatrix} \quad (1)$$

3. Result

First, we showed the trace of each part in 3D. We showed figure 3 to the trace of the emotionless.

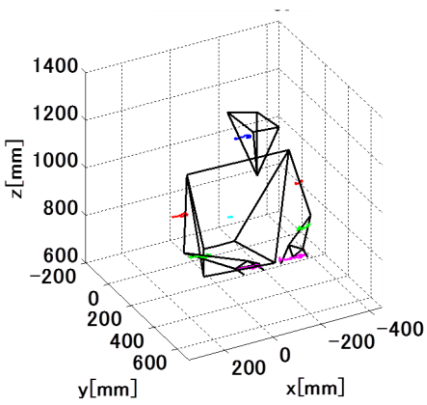

Figure 3. The trace of the emotionless in 3D

The study showed the trace from the lateral direction to watch movement. We showed the results in each emotion (Figure4-9).

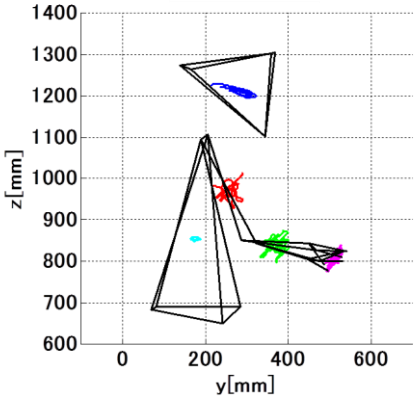

Figure 4. The trace of the happiness from the lateral direction

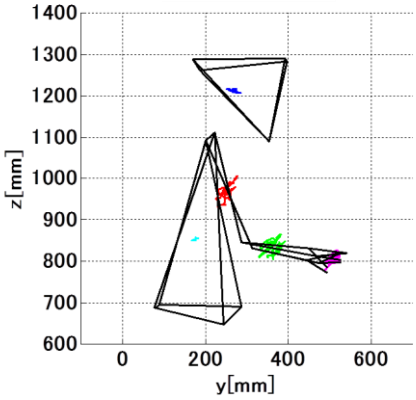

Figure 7. The trace of the sadness from the lateral direction

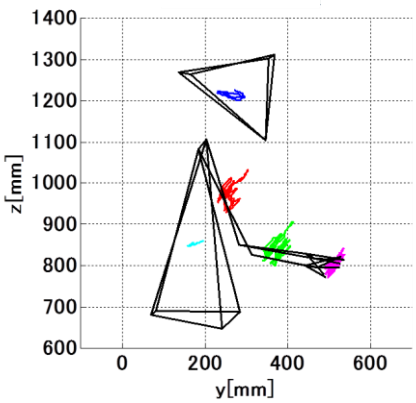

Figure 5. The trace of the tenderness from the lateral direction

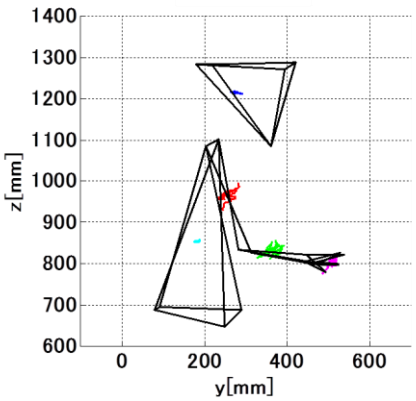

Figure 8. The trace of the fear from the lateral direction

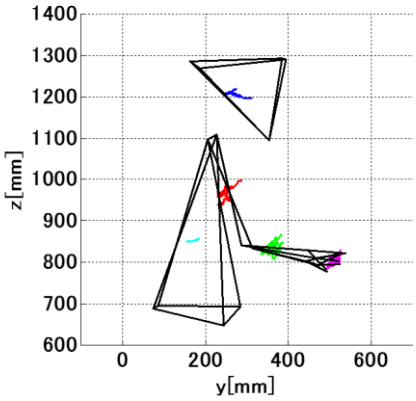

Figure 6. The trace of the anger from the lateral direction

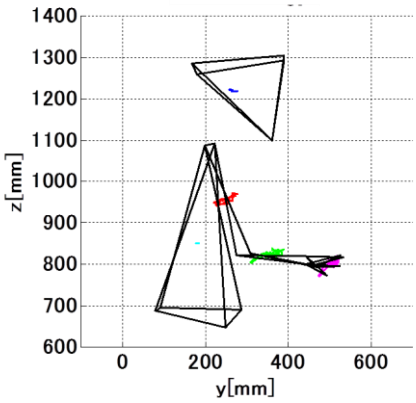

Figure 9. The trace of the emotionless from the lateral direction

From the figure, movement was big in order of happiness, tenderness, anger, sadness, fear, emotionless. The positive emotion was big movement, and the negative emotion was small movement. The difference of trace of the body part was big in the head and upper arm. On the conversely, the difference was not over the forearm, hand and torso. From this, the difference of the performance in emotion emerges in the head and upper arm. In other words, the head and upper arm are important to emotional expression of the performance.

4. Conclusion

This study examined an association between emotion and movement of the body part during the keyboard instrument performance. As a result, there was a difference in the emotional expression of the performance in the head and upper arm. In this way, we understood that the part except the hand was important to emotional expression in the keyboard instrument performance. The future investigation is going to analyze the front.

5. Acknowledgment

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