

Analysis of Music Communication between a Player and a Listener with Handclap

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Abstract: In this research, to analyze “a feeling of unity” at a concert hall, we investigated the relationship among listener’s respiration and handclap and the music. As a result, it was shown that listener’s respiration and handclap preceded to musical note. This result suggests that the predictive actions have influence to listener’s subjective mental condition.

1. Introduction

At a concert hall, audiences are sometimes impressed “a feeling of unity”. It is suggested that this feeling is caused from the music communication between a player and a listener.

Some studies of music communication are about symmetric interaction, such as a relationship between player and player^{1),2)}. And others are about dissymmetric ones, such as player-listener³⁾. In one of the latter, It was attempted that interaction between player and listener was explained from the viewpoint of the entrainment⁴⁾. In this study, player and listener were face-to-face during the performance, and it was discovered that there was the mutual entrainment between period of a bar and period of listener’s respiration. However, only the relation between listener’s respiration and music is not enough to explain “a feeling of unity”, because audience clap their hands and swing their body to the music at the live performance. Their action may increase the function to the both of performer’s and listener’s inner sense. In this research, in addition to the former, a listener was asked to clap in rhythm to music.

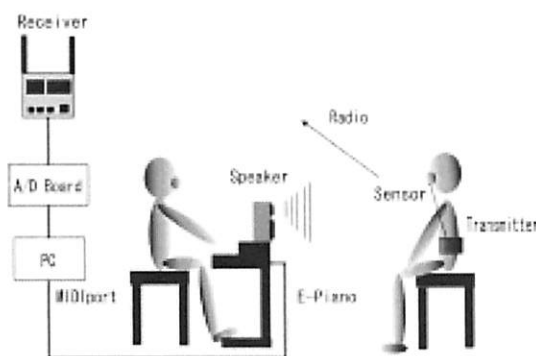


Fig.1 Measuring system of a live performance

2. Method

Here shows the experimental condition in Fig.1. This experiment was realized with face to face by a player and a listener. The respiration of listener was measured with the nasal cavity thermister (NIHON-KHODEN: TR-511G), and the performance was measured with MIDI file in the computer. The timing of handclap was measured with the wired electrode on the hands.

Four subjects (twenties, students) join the experiments. The title of the music used in this experiments was "Ellie, My Love" composed by "Southern All Stars". Subjects listened to the music clapping with the beat. Each experiments was started 10sec after measurement was started. Each subjects was measured 3times at the same conditions.

3. Results

Fig.2(a)-(c) show the relation among listener’s respiration and the timing of handclap and the music. To be more precise, Fig.2(a) shows the synchronization error between handclap and music, (b) shows the relation between their respiration and handclap, and (c) shows between their relation between their respiration and handclap. Value at each time is (a) difference between the time when the sound of handclap is detected and the time when the piano sound corresponding to the handclap is detected, (b) difference between the time when the peak of respiration wave is observed and the time when the piano sound corresponding to the peak, and (c) difference between the peak of respiration and the piano sound. In case of (a), the synchronization error is positive value when music is preceding handclap and negative when handclap is preceding music. And in case of (b), the synchronization error is positive value when respiration is

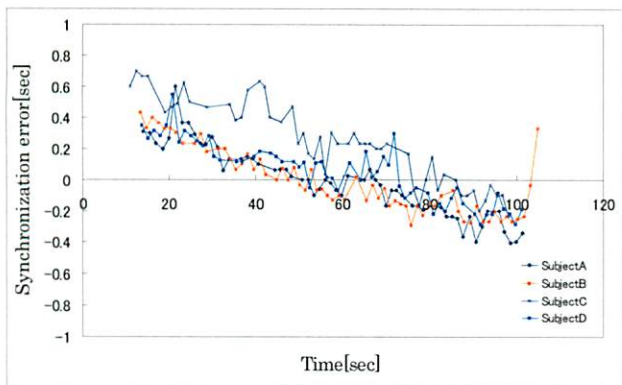


Fig.2(a) synchronization error between handclap and music

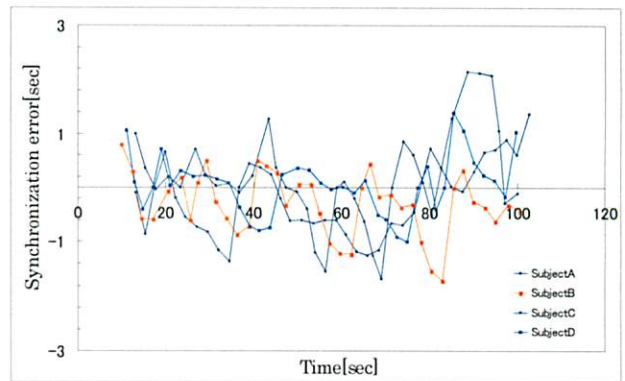


Fig.2(b) synchronization error between music and their respiration

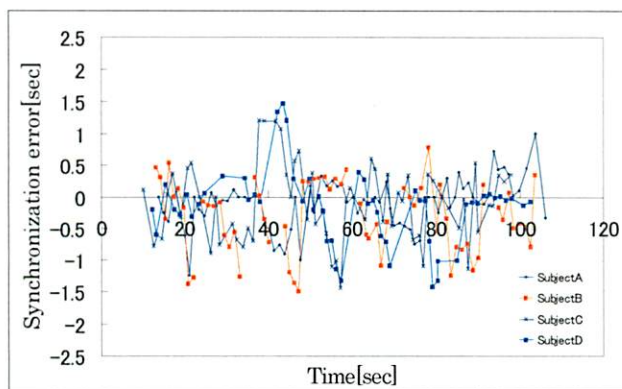


Fig.2(c) synchronization error between their respiration and handclap

preceding music and and negative when music precedes to respiration.

To see at (a),handclap was preceding music at 70-80sec.At this time,music melody had changed (about 70sec) . In (b), error value was steadily increasing during the performance and at the about 80sec ,the value was positive,in other words , respiration was preceding music. And in (c),there was a constant fluctuation ,but average error value is about zero.

4. Discussion

From the former study, it is clarified that the period of the bar in the music played and the listener's respiration period is synchronized in the musical performance. However, in this study it is clarified that listener's respiration was preceding the music. From a result of Fig.3(c), respiration and handclap were preceding music together,and this result was backed up by the former study⁵⁾. Accordingly, it is suggested that the respiration was getting faster by the synchronization. In addition, the fact that the passive listener's action changed into predictive action from the time which music change dynamically was able to corresponded to the listener's subjective mental condition.

It was suggested that these results was used for the method to explain "a feeling of unity"at live performance.

5. Conclusion

In this study, it was attempted that the feeling of unity in the concert or live performance was explained from the viewpoint of the musical communications between player and listener. As the results, at the listener's side, it was suggested the existence of the predictive actions that he tried to read the future instruments, and did the correspondence of listener's subjective mental condition. In future works, we planed to analyze the system not only at the listener's side but also at the player side from the view point of mutual interaction with them.

6. References

- [1] Y.Kobayashi,Y.Miyake,"New ensemble system based on mutual entrainment",2002
- [2] Waki,H.Kato,N.Iguchi, "-JASPER-"Proc.of IEICE,Vol.35,No.7, pp.106-107,1995
- [3] K.Ohgushi, "How Are the Player's Ideas Conveyed to the Audience?" Music Perception, Vol.4, No.4, pp.311-324, 1987.
- [4] T.Yamamoto and Y.Miyake, "Analysis of Interaction in Musical Communication and Its Modeling," Proc. of 2000 IEEE International Conference on Systems, Man, and Cybernetics, pp.763-768, 2000.
- [5] R.R.Bechbache and J.Duffin, "THE ENTRAINMENT OF BREATHING FREQUENCY BY EXERCISE RHYTHM," J.Physiol, 272, pp.553-561, 1977.