Analysis of Music Communication between a Player and a Listener with Hand clap

Norimasa Fujii, Tomohito Yamamoto, Yoshideiro Miyake

Dept. of Computational Intelligence and Systems Science,
Interdisciplinary Graduate School of Science and Engineering,
Tokyo Institute of Technology, Yokohama, 226-8502 Japan
hujj@myk.dis.iitc.ac.jp tyama@myk.dis.iitc.ac.jp miyake@dis.iitc.ac.jp

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

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 hand clap was measured with the wired electro-e 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 hand clap and the music. To be more precise, Fig.2(a) shows the synchronization error between hand clap and music, (b) shows the relation between their respiration and hand clap, and (c) shows between their relation between their respiration and hand clap. Value at each time is (a) difference between the time when the sound of hand clap is detected and the time when the piano sound corresponding to the hand clap 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 hand clap and negative when hand clap 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 study. 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.

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 predicative 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 viewpoint of mutual interaction with them.

6. References