A Cross-cultural Comparison Study of the Production of Simple Rhythm Patterns

Makiko Sadakata*, Kengo Ohgushi**, Peter Desain*

*Music, Mind, Machine Group, NICI, University of Nijmegen
**Department of Music, Kyoto City University of Arts

email: m.sadakata@nici.kun.nl

Abstract
As has been argued there may be a difference between Japanese and Western musicians in performing western music. However, there were few studies providing physical basis for such a claim. The aim of this study is to compare Japanese and Western musicians with regard to the timing in the production of simple rhythm patterns to examine whether these are physically different. Six Japanese and six Dutch percussion players performed nine kinds of rhythm patterns consisting of two notes in two performing modes in three tempi. Performed tempo and the duration ratio of two notes were analyzed. Dutch and Japanese players had common tendencies: performed tempo was affected by instructed tempo, deviation of performed duration ratio from instructed ratio varied with different rhythm patterns. Furthermore there seemed to be aspects which distinguish Japanese, performing the 4:1, 5:1, 1:4 and 1:5 patterns with a smaller duration ratio than the ratio given by the scores.

1 Introduction
Musicians read the information from the musical score and convert it into sound sequences. One may wonder how deeply rooted these processes are in human cognition and whether the relations found are valid across cultural boundaries.

There are several interesting statements about performance of western music by Japanese musicians. For examples, a Japanese conductor Hideo Saito (Saito, 1999) who was well known as the music teacher of the conductor Seiji Ozawa described the way of playing of Mozart' pieces which music teachers taught in Japanese musical university was just like Mozart after the Japanese fashion. Minao Shibata (Shibata, 1987), a well-known Japanese composer described that the recent young Japanese musicians have just noticed that the sensibility of the Japanese people for music was substantially different from that of Western people.

As represented in these statements, some people have the opinion that performances of Japanese musicians are somewhat different from those of Western musicians. However, these reports are mostly based on their impressions. Is there a physical basis that might cause the difference?

Gabrielsson (Gabrielsson, 1987) analyzed five pianists' performances of the first eight measures in Mozart's Piano Sonata in A-major (K.331) with regard to timing. The timing played by his one Japanese pianist sometimes differed from that of the other Western pianists. Ohgushi (Ohgushi, 1999) also reported a different tendency in production of the rhythm patterns consisting of three notes whose duration ratio is 3:1:2. Japanese pianists tended to produce the duration ratio of the first two notes (3:1) as smaller than the Western pianists did. To investigate this tendency in detail, we focused on the simple rhythm patterns consisting of only two notes and compared Japanese and Western musicians with regard to the timing in the production of these patterns.

2 Method
Twelve percussion players participated in the experiment as subjects. Six of them were professional musicians residing in the Netherlands. The other six were percussion major students at Kyoto City University of Arts in Japan. Subjects were asked to perform several rhythm patterns consisting of two notes whose duration ratios were 1:1, 1:2, 1:3, 1:4, 1:5, 2:1, 3:1, 4:1 and 5:1, respectively. They were instructed to perform at three different tempi (60, 75 and 90 beats per minute) and to practice using a metronome before each performance. Furthermore, subjects were requested to perform in two modes: to play mechanical and in a musical way. They were given different scores and instructions for each mode as shown in Fig.1 and Fig.2. In the mechanical mode (Fig.1), subjects were instructed to repeat the pattern ten times as accurately as possible.
In the musical mode (Fig.2), subjects were instructed to perform as if they were performing a short piece of music. Subjects were instructed to perform with one hand, using a wooden stick. As drum surface, a piezo contact microphone encapsulated in a plastic box covered with a thin sheet of rubber was used. The performances were recorded on DAT using a sampling frequency of 44.1 kHz.

The time interval from an onset of one note to the onset of following note was measured using POCO (Desain&Honing, 1992).

3 Results

3.1 Tempo

To begin with, we studied in how far a constant tempo is maintained. The beat duration was measured as the total length of the first and second note's duration. Performed tempo averaged over each performance data set can be calculated from the beat duration of each repetition of the rhythm patterns. Fig.3 shows the value of performed tempo of all performance data sets in the three tempo conditions at two subject-groups. A vertical axis indicates the value of performed tempo and horizontal axis indicates the tempo conditions, respectively. Circles
in the figure represents the value of performed tempo of all performance data set. Subjects seemed to perform rhythm patterns with a variety of tempi. It also shows that the performed tempo inclined to the faster tempo at the slowest tempo condition (tempo 60) compare to two other conditions.

To examine the influence of tempo, mode and rhythm pattern on performed tempo, ANOVAs for averaged percent deviations from the instructed beat duration of obtained beat duration averaged over each performance data set were conducted. The results of ANOVAs indicated tempo conditions affected on the deviation of obtained beat duration significantly. Modes and rhythm patterns seemed to partly have an effect on it.

### 3.2 Duration ratio

We also focused on the duration ratio of two notes being included in one rhythm pattern. For this the duration ratio was calculated as the longer duration divided by the shorter duration. In the case of 1:1, the duration ratio was calculated as the second note's duration divided by the first note's duration. Fig.4 shows all the values of duration ratio performed by two subject-groups. A vertical axis indicates the value of obtained duration ratio and horizontal axis indicates the kinds of rhythm patterns, respectively. The figure shows that the more diverse timing was obtained in the case of rhythm patterns having the larger duration ratios. Further, Dutch subjects seemed to perform all rhythm patterns with more diverse timing than Japanese subjects did. There were some values of duration ratio performed by Dutch subjects being above the instructed duration ratio in every rhythm pattern, while the values performed by Japanese subjects were seldom above the instructed duration ratio in the case of the instructed duration ratios 4 and 5.

To examine the influence of tempo and mode conditions and rhythm patterns on performed duration ratio, averaged percent deviations from the instructed beat duration of the performance data sets were analyzed. Furthermore, the difference between subject-groups was examined. The results indicated that the performed tendency of duration ratio varied with the kind of the rhythm pattern and the subject-group. Performed tendency of duration ratio did not vary with mode and tempo conditions. The averaged duration ratios were significantly smaller for Japanese than for Dutch in the case of 1:4 and 1:5.

Fig.4 Performed duration ratio in nine rhythm patterns at two subject-groups.
4 Discussion

The difference between the two subject-groups was not only nationality but also the amount of musical experience. On average the Dutch and Japanese subjects had 21.5 years and 17.8 years of musical training experience, respectively. Generally speaking, subjects with long experiences could produce more stable performance than subjects with short experiences could. One of the good indices of measuring the stability of the performance is the standard deviation (SD).

The averaged SDs of obtained percent deviations of beat duration and duration ratio at mechanical mode within every performance data set were calculated. Furthermore, the SDs of Dutch and Japanese groups for every rhythm pattern were calculated by averaging SDs within each national group. Both t-tests on the averaged SDs of beat duration and duration ratio showed no significant differences between Dutch and Japanese groups. Although averaged period of musical training of Japanese subjects were shorter than of the Dutch subjects, the stability of the performance was not significantly different in both groups as measured by SDs in this experiment.

The tendency of Japanese players to perform a 4:1, 5:1, 1:4 and 1:5 patterns with only a smaller duration ratio seems to agree with the opinion of Fumio Koizumi, a Japanese ethnomusicologist. He pointed out the Japanese musicians played dotted rhythm patterns with smaller duration ratio than the Western musicians did (Koizumi, 1984). He discusses the mother tongue may have an effect on the sense of playing rhythm.

Although there were not notable differences between Dutch and Japanese percussion players in the production of simple rhythm patterns, there seemed to be some aspects which distinguish to Japanese players.

5 Acknowledgments

Part of this research was funded by the Netherlands Organization for Scientific Research (NWO) and by the Canon Foundation.

References


