



## I. Introduction

- Native language rhythm and familiar rhythm in music are said to affect rhythm perception (Iversen, Patel & Ohgushi 2008; (Hannon and Trehub 2005).
- This view was tested here with Russian and Japanese participants.
- Russian speech rhythm is based on stress (the language is said to be "stress-timed").
- In Japanese the duration between accents is irregular due to frequent unaccented syllables.
- Both languages use irregular rhythms in their traditional music genres.

**Research questions:** If mother tongue rhythm and musical experience affect the ability to detect rhythmic differences, then

- Will a rhythmic difference between Russian and Japanese affect rhythm perception (e.g. will the Japanese participants tolerate lapses in rhythm more than Russian participants)?
- Will musical experience make participants more sensitive to differences in rhythm structure?
- Will Japanese participants and Russian participants respond differently to linguistic, tonal and musical stimuli?

### Participants

18-32 years old 37 Japanese musicians (29F, 8M); 31 Japanese non musicians (20F, 11M); 33 18-25 years old Russian non musicians (30F, 3M)

### Stimuli

- Linguistic stimuli were a succession of [ma] syllables
- The musical, linguistic, and pure tone stimuli had the same rhythm structure, with either regular or irregular rhythm

#### Regular Rhythm Stimuli (familiarization)

Regular Rhythm Stimulus  
\* \* \* \*  
\* \* \* \* \* \* \* \*

The duration between accented items was regular. This is similar to the rhythm of "stress-timed" Russian.

#### Irregular Rhythm Stimuli (familiarization)

Irregular Rhythm Stimulus  
\* \* \* \* \* \* \* \* \* \*  
\* \* \* \* \* \* \* \* \* \*

The duration between the accented items is irregular. This type of rhythm is found in Japanese language and music, and in Russian music.

## II. Methods

### Task

- Participants were asked to rate (from 1 = very similar to 6 = very different) the rhythmic difference between two sound files, a familiarization stimulus and a test stimulus
- Each participant provided 168 responses (14 pairs × 4 stimulus types × 3 repetitions)

**Test Stimuli** are variants of the familiarization stimuli

#### Structure preserving (SP) test stimuli:

SP1: identical to familiarization stimuli

SP2: an element is removed, but the one preceding it is twice as long

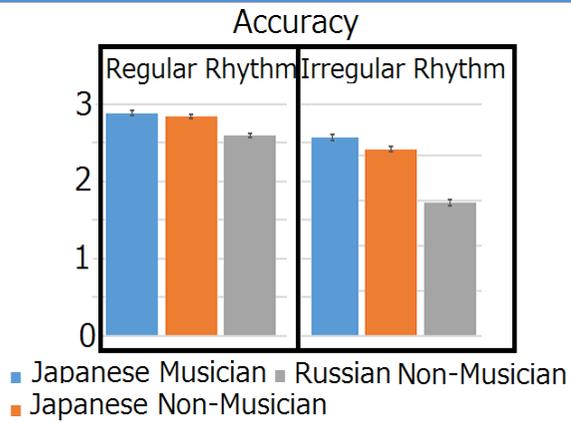
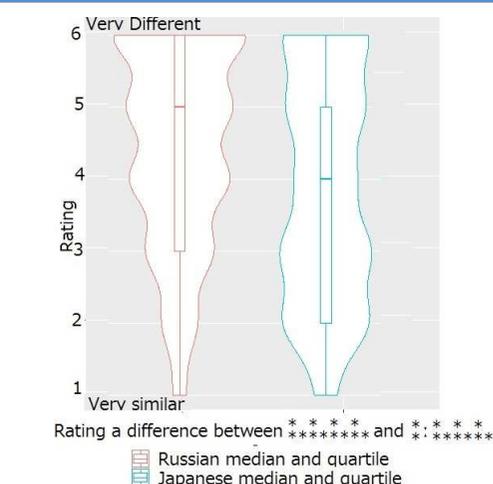
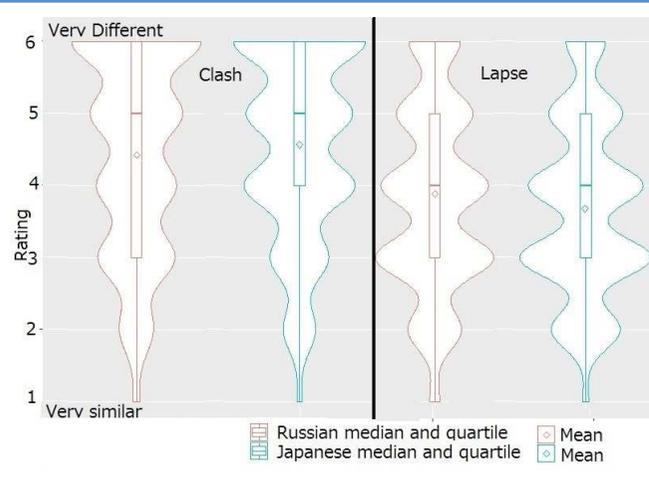
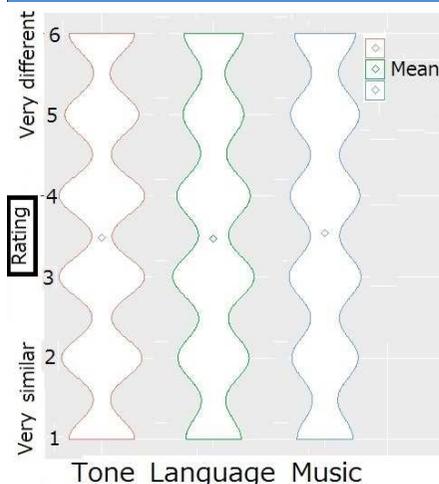
#### Structure Violating Stimuli

**Lapse1 and 2** : one or two extra weak (W) elements are added to the familiarization stimulus

**Clash1 and 2** : two strong (S) elements are next to each other without length adjustments (as in SP)

Regular Rhythm			Irregular Rhythm		
Familiarization Stimulus: SWSWSWSW			Familiarization Stimulus: SWSWWSWSWW		
Structure Preserving	Lapse Types	Clash Types	Structure Preserving	Lapse Types	Clash Types
SWSWSWSW	SWSW <b>W</b> SWSW	<b>SS</b> WSWSW	SWSWWSWSWW	SWSW <b>W</b> SWSWW	<b>SS</b> WWSWSWW
S:SWSWSW	SWSW <b>W</b> SWSW <b>W</b>	<b>SS</b> W <b>SS</b> W	S:SWSWSW	SWSW <b>W</b> SWSWW <b>W</b>	<b>SS</b> W <b>SS</b> WW

## III. Results and Conclusions



There is no significant statistical difference between types of stimuli [Kruskal-Wallis test,  $\chi^2 = 4.6231$ ,  $df = 2$ , n.s.]. This result supports the view that rhythm is processed in similar manner across modalities. This suggests that we can extrapolate about speech rhythm perception from experiments with music or tones as stimuli.

There is no difference between Russian and Japanese (nonmusician) participants when they rate clashes [Wilcoxon  $W = 292510$ , n.s.]. However a difference is found in lapses [Wilcoxon  $W = 604620$ ,  $p < 0.05$ ]: Japanese participants tolerated lapses slightly better than Russian participants, possibly due to greater familiarity with lapses in their language. Both groups were more sensitive to clashes than lapses. [for Japanese; Wilcoxon  $W = 566270$ ,  $p < 0.001$ , ], [for Russian; Wilcoxon  $W = 557620$ ,  $p < 0.001$ ].

Japanese participants were less sensitive to SP2, where rhythm is preserved by lengthening a vowel [Wilcoxon  $W = 86806$ ,  $p < 0.001$ ]. This is possibly because long vowels count as two moras in Japanese, indicating that the Japanese participants' rhythm percepts were based on moras not syllables (as expected).

Accuracy is the difference between the mean rating for structure-violating stimuli (clashes and lapses) and SP1 (identical test and familiarization). Even in irregular rhythm, music education did not significantly affect accuracy [F = 1.5 (1, 4676), n.s.]. The major difference is between Japanese and Russian in irregular rhythm [F = 24.49 (1, 4527),  $p < 0.001$ ]: Russian participants were less sensitive to deviations than Japanese participants. This suggests that musical experience does not strongly affect rhythm perception; linguistic experience, however, does.