

Tuning accuracy of perfect fifth for music university students

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1. Introduction

Japanese music universities tend to concentrate on training the ability to distinguish pitch. Notably, although Japanese music university students excel at distinguishing absolute pitch in comparison to their western counterparts, their sense of relative pitch is relatively lacking [1]. As relative pitch is the foundation of musical harmony [2], it is an important ability in musical performance. In a previous study, it was shown that perfect 8th is easier to understand than perfect 5th [3]. Instrumental musicians showed higher accuracy in relative pitch than in people with no musical experience [4]. However, there is little research on the capabilities of distinguishing relative pitch in Japanese music university students. Therefore, in this research, we investigated the accuracy in tuning of perfect 5th by students in music universities.

2. Experiment

2.1 Participants

There were 14 music university students who participated in this experiment. Of the 14, 3 were male, 11 were female (*M*: 22 years). All participants had more than 10 years of specialized education in piano.

2.2 Method

To mimic part of the open strings of a violin and cello, 3 registers of perfect 5ths were set up in the experiment in the form of A4 and E5, G3 and D4, G2 and D4. The reference tone was the lower tone, and the test tone was the higher tone. The interval between the test tone and the reference tone was set up in increments of 10 cents for each keyboard key pressed. The stimulus sound was a synthetic sound simulating the sound of a piano [5]. Two different types of experiments were set up; one in which 2 perfect 5th sounds are heard simultaneously and another where 2 perfect 5th sounds are heard sequentially. All stimuli has a duration of 250 ms. The experiment was conducted over MATLAB via an USB audio

interface (Roland, UA-25EX) and headphones (Sennheiser, HDA 200) for subjects to hear the same sound in both ears.

2.3 Procedure

The participants first carried out the tuning test with stimuli played simultaneously, followed by the test with sequential stimuli. Participants tuned the test note from the reference tone at perfect 4th or major 6th to perfect 5th. By pressing the key on a computer keyboard, participants were able to change the pitch by 10 cents, and when the participants have judged that the interval between the reference and test note has been tuned to a perfect 5th, they responded by pressing the Enter key. The participants tuned the following six sets: A4~D5, A4~F#5, G3~C4, G3~G4, G2~C3, and G2~E3 for both the simultaneous and sequential tests, each repeated twice in random order.

3. Result

Table 1 Average value and standard deviation of each set

Simultaneous (cent)						
Set	G2 C3	G2 E3	G3 C4	G3 E4	A4 D5	A4 F#5
A. V.	135.00	129.29	63.57	98.57	76.43	134.29
S. D.	164.00	170.19	83.46	143.02	88.20	168.68
Sequential (cent)						
Set	G2 C3	G2 E3	G3 C4	G3 E4	A4 D5	A4 F#5
A. V.	94.29	120.71	82.14	100.71	72.14	73.57
S. D.	144.01	240.31	141.13	140.53	138.63	137.87

The first trial for both tests were considered to be training data for the participants to get familiarized with the tests and therefore only results from the second trial are shown. Overall, in Table 1 the simultaneous tests had greater deviation in pitch compared to the sequential tests. Specifically, the lower register G2-C3 simultaneous test had a mean deviation of 135.00 cents. On the other hand, although the A4-D5 sequential test deviated by 72.14 cents, the interval deviation was the smallest in this experiment. In addition to this, the individual difference in the G2-E3 sequential test was the

largest, while the individual differences in G3-C4 simultaneous test was the smallest.

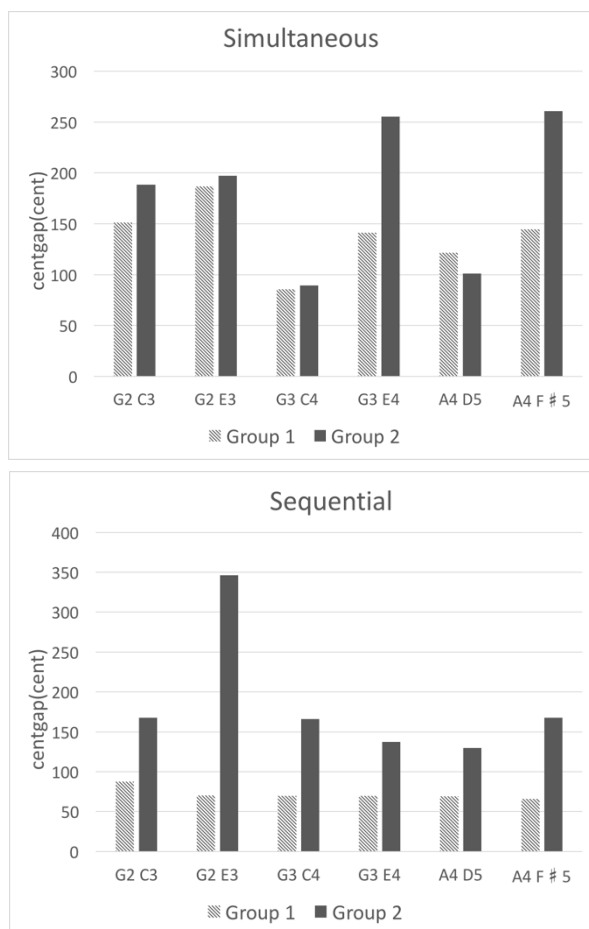


Fig.1 Comparison of experience of musical instrument

Fig.1 divided experiment participants into two groups. Group 1 consists of six participants who have violin experience. Group 2 consists of eight participants with experience in other instruments. Group 1 achieved higher accuracy and significant difference in the sequential test [$F(5,7)=0.009$, $p<0.01$] compared to Group 2. But, there was no significant difference in the simultaneous test [$F(5,7)=0.109$, $p>0.05$]. Both groups had the least deviation for G3-C4.

4. Discussions

Overall, individual differences were large. Moreover, the sequential tests were much more accurate in comparison to the simultaneous tests. In this experiment, the simultaneous tests were always followed by the sequential tests. It is possible that because the participants did the sequential tests later, they were already familiar with the perfect 5th interval.

Overall, the results were worse than expected, possibly due to the stimuli being synthetic piano sounds, which the participants may not be used to

hearing. This is also supported by Hopkins' study, where he found the testing software to affect the results [6]. The accuracy for G3-C4 was the highest. This is likely due to students frequently listening to G3- C4 and it is within a pitch range often played, thus can be easily recognized. Tuning downward from major 6ths were especially inaccurate, suggesting that it is more difficult to tune from a major 6th than a perfect 4th.

As shown in Fig. 1, the accuracy in the simultaneous test was low in both groups. But the group with the violin experience had greater accuracy in sequential tests compared to those with experience in other musical instruments. This is likely that people with violin experience have better training in violin tuning and thus are able to correctly judge the intervals.

5. Conclusion

In this research, we investigated the accuracy in tuning perfect 5th intervals by students in music universities. Overall, the differences between individuals were large. The accuracy of sequential tests was higher than simultaneous tests. In addition, people with violin experience had higher accuracy in sequential tests than those with experience in other instruments. Due to the fact that the differences among individuals are very large in this experiment, we need to consider improving our current test design.

6. Acknowledgment

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7. References

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