

Research regarding the positions of 4 supports for the baseplate of a speaker stand and the effect of reducing the noise of the mounted speaker

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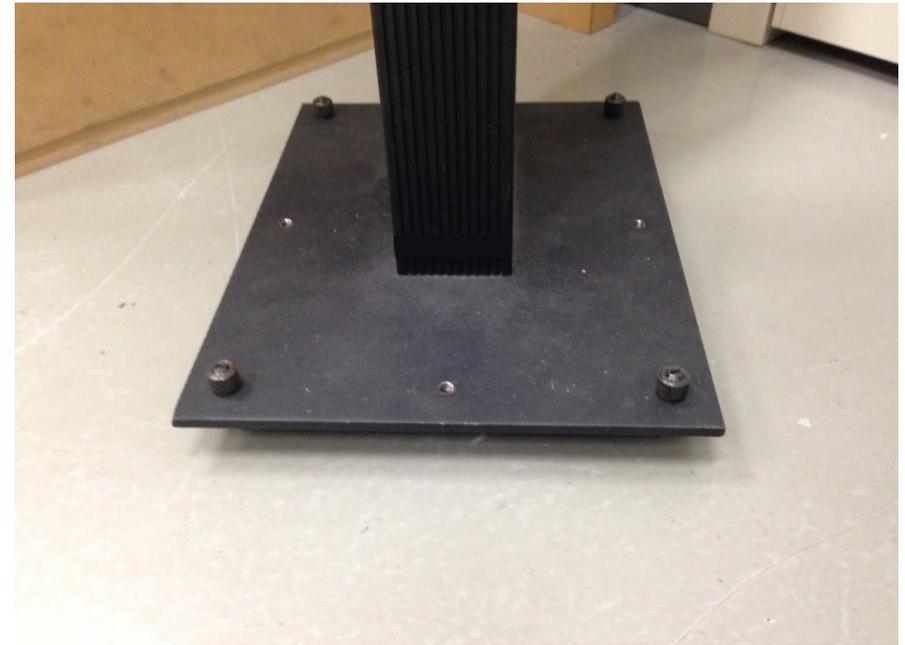
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I. Background of Research

It is known that when music is played with audio equipment, sound quality degrades because of noise produced by various factors.

It is common to use audio accessories in order to improve the sound quality of audio equipment. These definitely change sound, but it is unclear whether it means improvement.

In this research, the authors focused on a speaker stand, and experimentally discussed the effects of the positions of the supports for its baseplate on the mounted device.



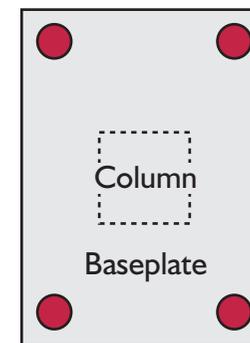
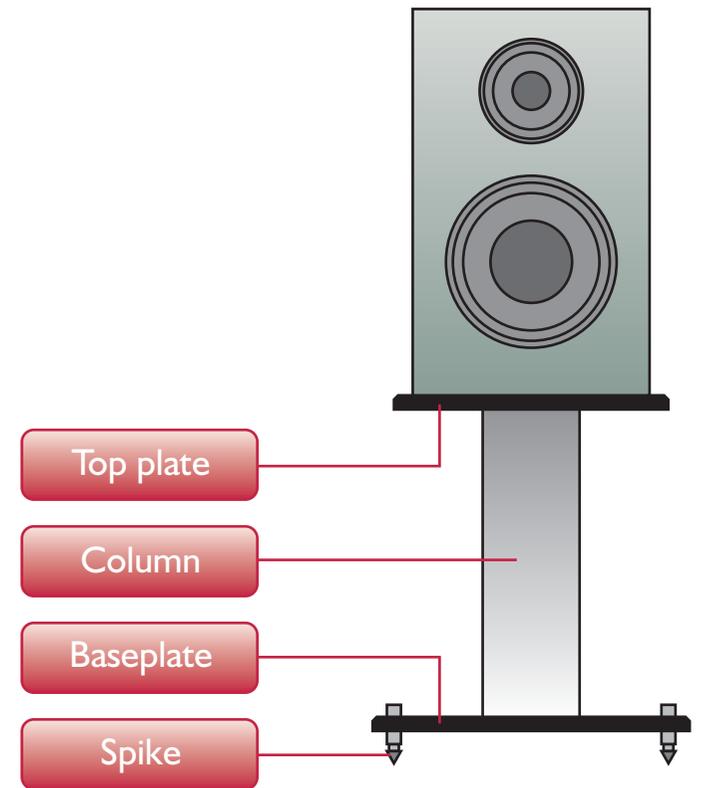
2. Purpose of Research

The purpose of this research is:

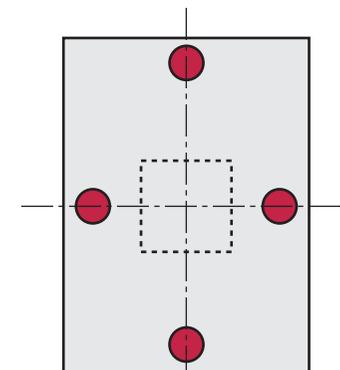
Effects of reducing the noise and vibration on the mounted speaker



The effect of improving sound quality based on a listening experiment.



4 angular points for supporting



4 middle points for supporting

3. Experiment method

The authors discussed each supporting method effects of reducing the vibration and noise on the mounted speaker.

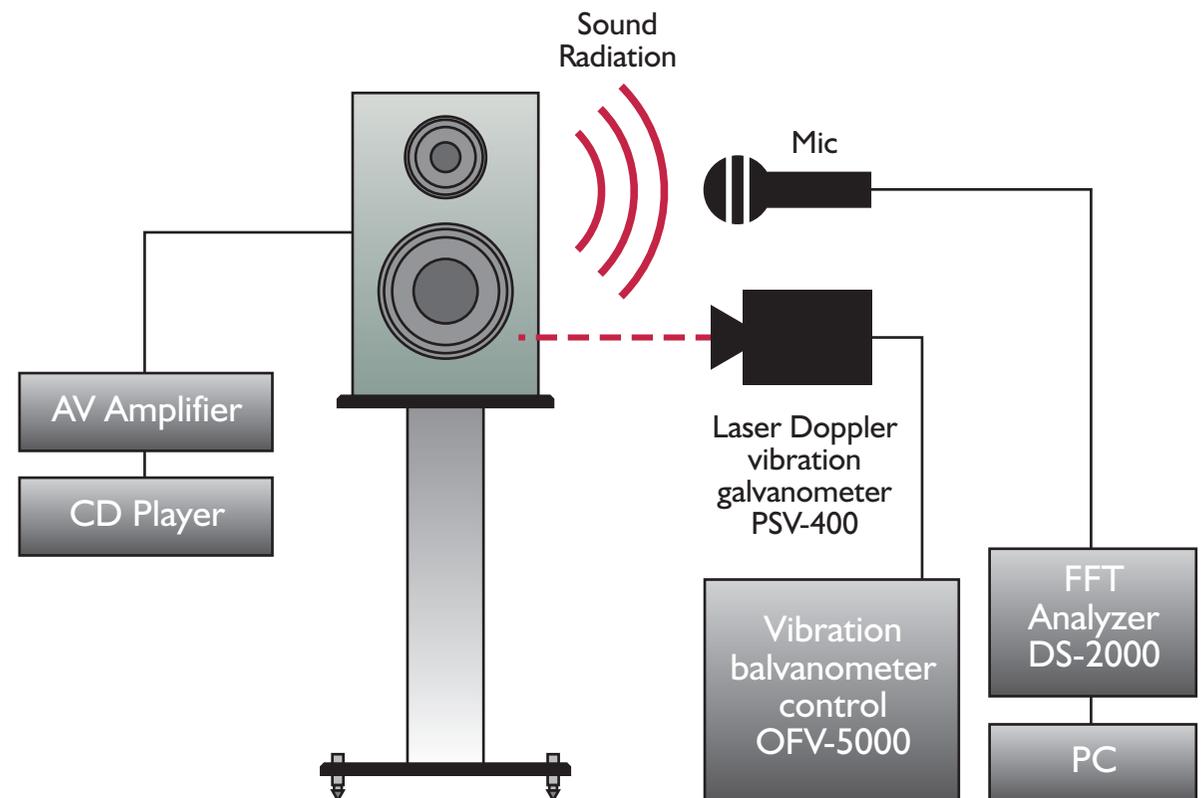
The authors made the speaker generate radiating sound, and studied the effects on the baffle surface, the unit part, and the radiating sound.

White noise →

Vibrational characteristics of the
baffle surface

Sine-wave signal →

Vibrational characteristics of the
unit part Effects on radiating
sound (harmonic components)



4. Experiment Results and Discussion

4.1 White noise

The vibration range shrank in the enclosure part surrounding the unit.

It can be considered that vibration was suppressed in the case of supporting at 4 middle points.

4.2 Sine-wave signal (unit part)

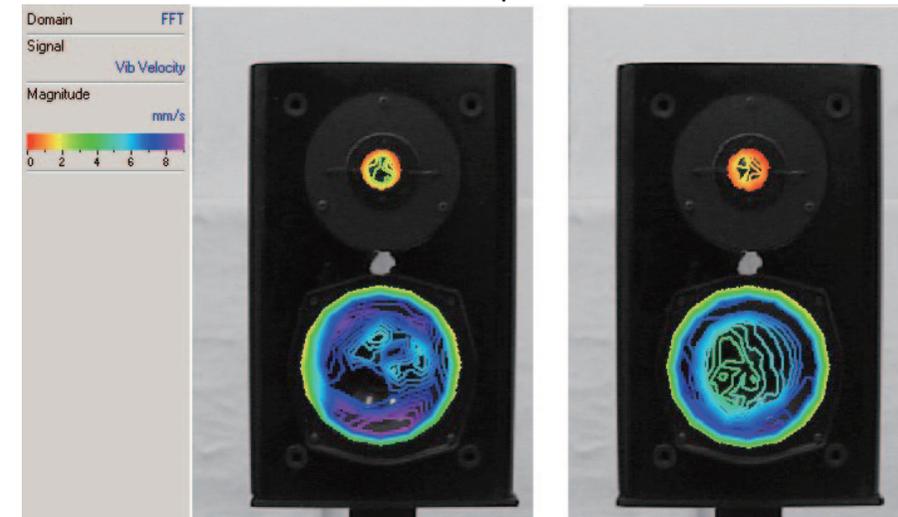
The vibrational distribution at the woofer part became nearly concentric.

It can be considered that the distortion of the woofer part decreased.

Vibrational characteristics of the baffle surface



Vibrational characteristics of the unit part



supporting at
4 angular points

supporting at
4 middle points

4.3 Effects on radiating sound

Harmonic components mean **the noise** generated by resonance.



As harmonic components decrease, **vibration is dampened more.**

<Harmonic component damping amount for each supporting method>

Frequency[Hz]	Supporting at 4 angular points		Supporting at 4 middle points		Improvement [dB]
	Sound pressure level [dB]	Difference [dB]	Sound pressure level [dB]	Difference [dB]	
1000	-56.30	---	-56.43	---	0.13
2000	-99.05	42.74	-98.95	42.52	0.22
3000	-104.13	47.83	-104.97	48.55	-0.71
4000	-121.45	65.15	-120.55	64.12	1.03
5000	-114.19	57.89	-113.05	56.62	1.27
6000	-130.07	73.77	-130.86	74.43	-0.67
7000	-128.07	71.77	-130.86	74.43	-2.66
8000	-138.72	82.41	-142.67	86.25	-3.83
9000	-138.95	82.65	-140.71	84.28	-1.63

In the case of supporting at 4 middle points, third-order, sixth-order, and higher-order harmonic components decreased considerably.

This is considered because the distortion of the unit part eased.

5. Listening Experiment

In order to study how the above mentioned experiment results influence sound quality, we conducted a listening experiment and discussed the effect of **improving sound quality**.

Comments such as
"Sound quality is good" and "This is good sound"
Vary among people, and strongly **Depend on their preference**.



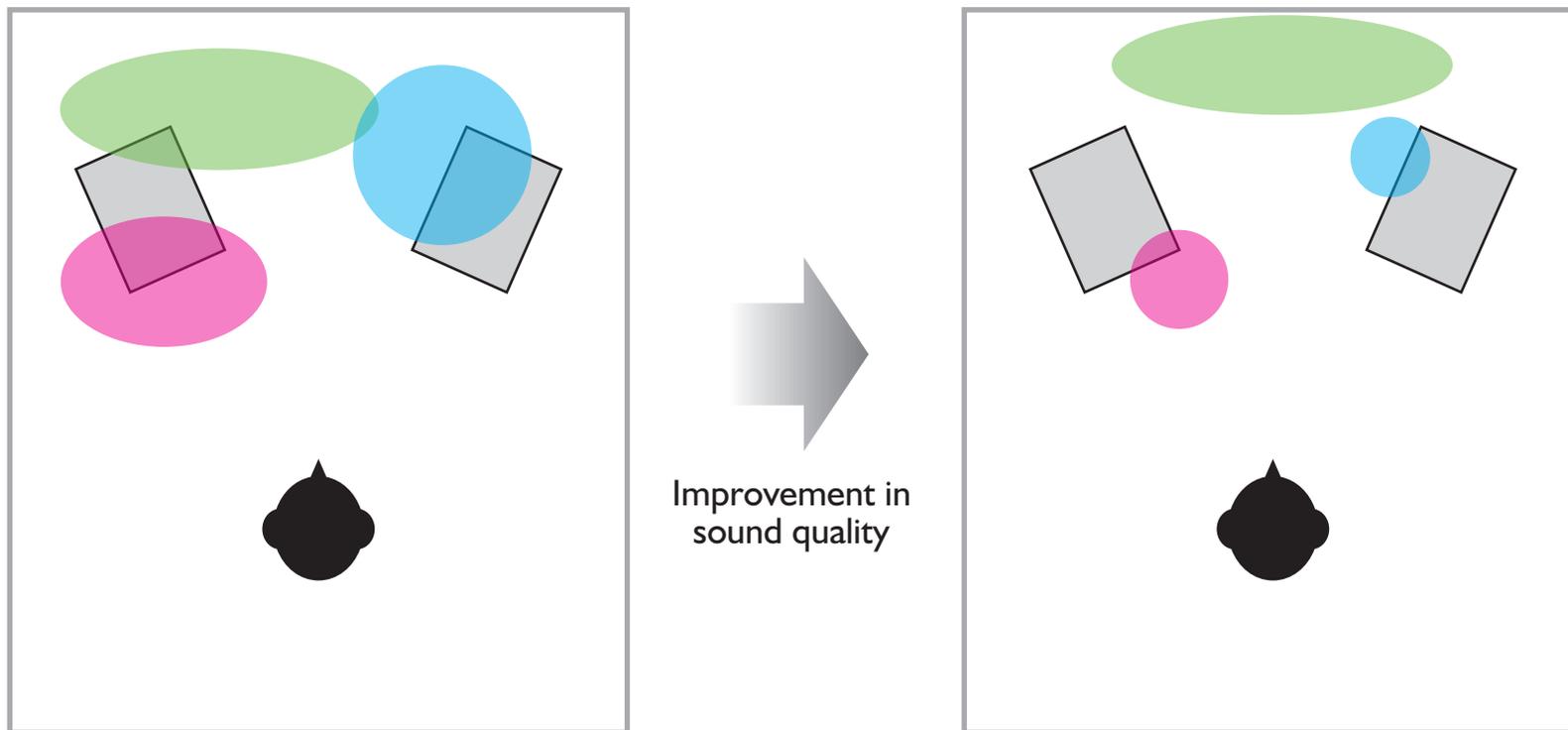
We carried out 2 kinds of experiments:
1. an auditory lateralization experiment
2. a sound quality evaluation experiment.

5.1 Auditory lateralization experiment

Auditory lateralization means the ability to grasp the direction and distance to a sound source.

When sound quality improves,

(1) the range and (2) phase of the audio image become clear.



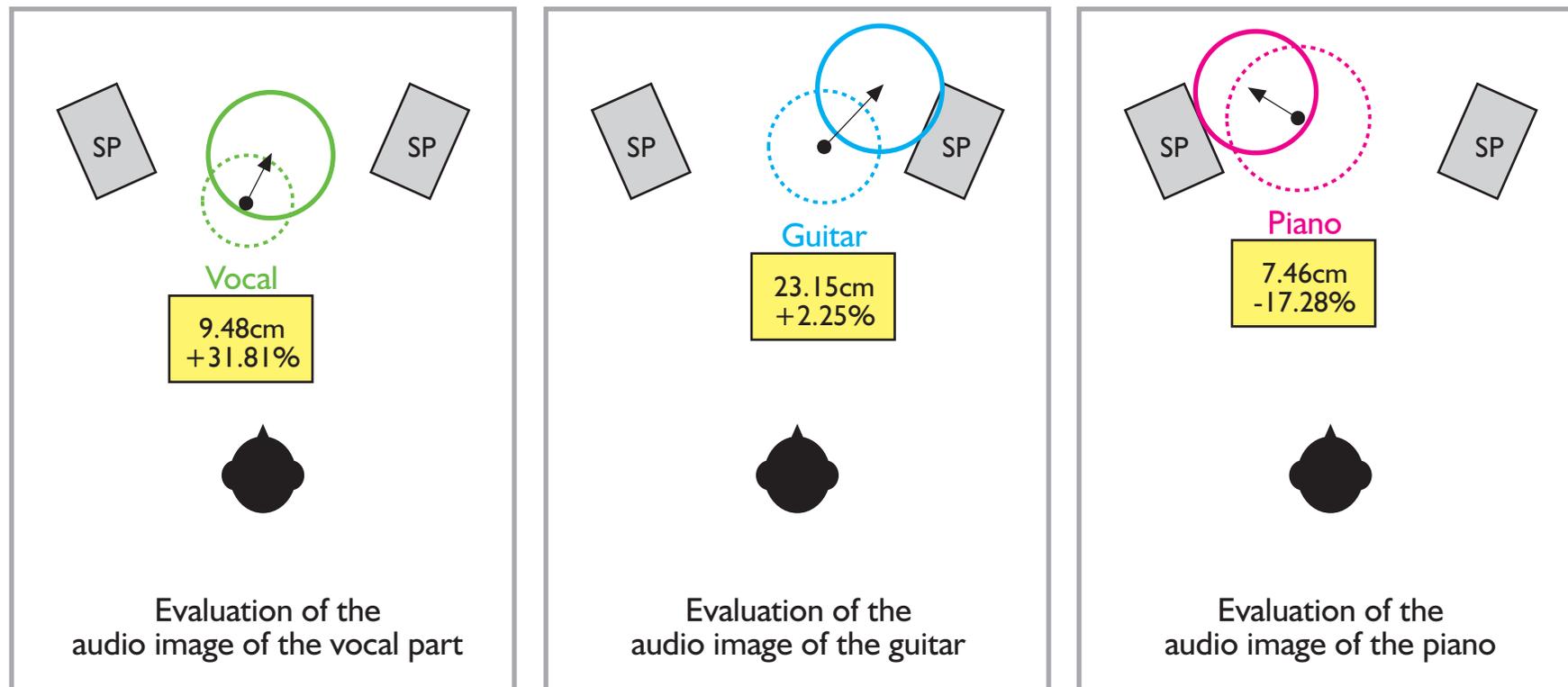
5.2 Experiment results (auditory lateralization)

Subjects drew **the audio image** of each sound source, and the **variations in area** and **coordinates** were summarized as data.

The right and left senses of auditory lateralization became clear.

The audio image of the piano became clear, while other audio images became vague.

The possible reason for the vagueness is that sound reverberation increased and it was sensed as an audio image.



5.3 Sound quality evaluation experiment

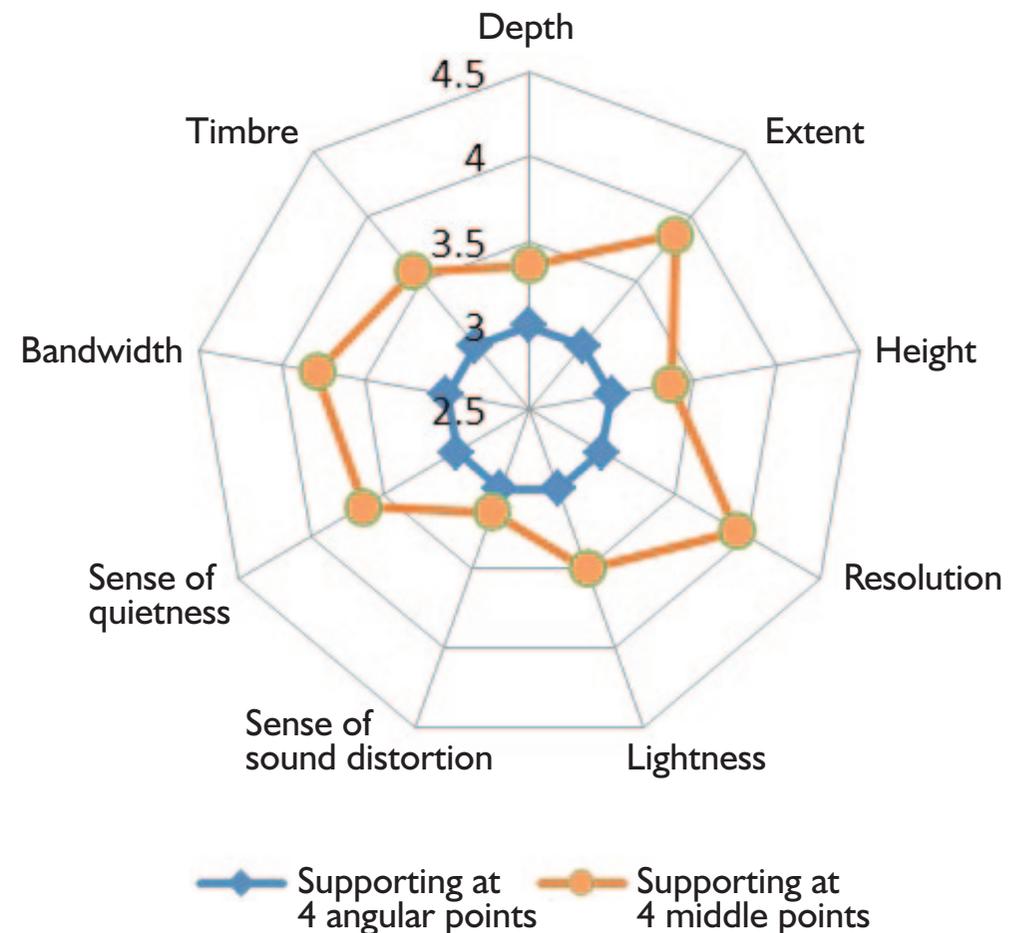
We set 9 items: depth, extent, height, resolution, lightness, sense of sound distortion, sense of quietness, bandwidth, and timbre.

Five-grade evaluation was conducted, while giving Grade 3 to the method of supporting at 4 angular points.

5.4 Results of the sound quality evaluation experiment

All items improved.

Especially, extent, resolution, and bandwidth improved considerably.



6. Conclusion

It was confirmed that the method of supporting at 4 middle points has the effect of damping vibration at both the unit and enclosure parts.

The effect of damping vibration and the reduction amount of harmonic components were larger in the case of supporting at 4 middle points.

The right and left senses of lateralization became clear through the auditory lateralization experiment.

In the sound quality evaluation experiment, all items improved. Especially, the effects on extent,



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