Elucidation of enhancement phenomena of the sound pressure level and repetitive components when applying pressure near the sound source

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Enhancement of the SPL and repetitive components

Sound post

[Diagram showing parts labeled 1 to 10]
Enhancement of the SPL and repetitive components

SPL and autocorrelation function (ACF)

With sound post

Without sound post

Normalized ACF (NACF)
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SPL and autocorrelation function (ACF)

With sound post

Without sound post

Effective duration of the ACF, $\tau_e$

Longer $\tau_e$ is correlated with higher clarity and intelligibility
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SPL and autocorrelation function (ACF)

SPL ($L_{Aeq}$)

\[ \begin{align*}
L_{Aeq} [\text{dB}] & \quad \tau_e \\
60 & \quad 0.5 \\
70 & \quad 1.0 \\
80 & \quad 2.0
\end{align*} \]

Vibrating string

- : With sound post
- : Without sound post
Purpose of this study

- The phenomenon can improve the SPL and speech intelligibility without additional power consumption

- Clarification of the enhancement of the SPL and repetitive components by applying pressure near the sound source
Experimental methods

- Board type and thickness
  - acrylic boards (AC: 0.5, 1 mm)
  - plastic boards (PL: 0.2, 0.3, 0.5, 1, 1.5 mm)
  - hard vinyl chloride boards (KE: 0.5 mm)
  - low foaming sheet boards (TE: 1, 2 mm)
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Autocorrelation function (ACF)

Waveform

- Sinusoidal wave
- Brain wave
- White noise

τ_e: ACF envelope 10-percentile delay
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Results for the music box (1)

SPL ($L_{Aeq}$)

Effective duration of the ACF, $\tau_e$

![Graph showing SPL and effective duration for different board thicknesses and materials.](image)
Results for the music box (2)

Measured SPL as a function of the 1/3 octave band center frequency
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Results for the loudspeaker and mobile phone (1)

SPL ($L_{Aeq}$)

Effective duration of the ACF, $\tau_e$

1-mm-thick plastic boards
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Results for the loudspeaker and mobile phone (2)

Measured SPL as a function of the 1/3 octave band center frequency
Summary

• Acrylic and plastic boards with thickness of 0.5 mm and a mid-range bending strength produced a higher SPL and longer $\tau_e$ for a music box.

• The phenomena was not well reproduced for the loudspeaker and mobile phone because of the weak contact between the board and the vibration part of the sound source.
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Thank you for your attention