

Exploring the Role of Temporal Fine Structure and Envelope in Timbral Coding

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Abstract—While the neural response to simple, stationary, and periodic auditory signals can be fairly well investigated, responses to auditory stimuli that are more complex, such as speech and music, are less well-characterized. Particularly, music is psychoacoustically complex. It is not well-understood how humans perceive the nuances of music, and how hearing impairment may affect the perception of such nuances. Before we can fully understand perception, we must first investigate how musical attributes like timbre are coded by the auditory periphery. By using a simulated auditory nerve model and comparing neural responses to stimulus envelope (ENV) and temporal fine structure (TFS), it is possible to see how timbral coding might be affected by hearing impairment. In this project, both instrumental timbre and articulation timbre were considered, and variations in coherence spectra of neural responses and Hilbert TFS/ENV were observed across instruments, articulations, and hearing impairment conditions.

Index Terms—auditory, neuroscience, music, modeling, envelope, temporal fine structure, timbre

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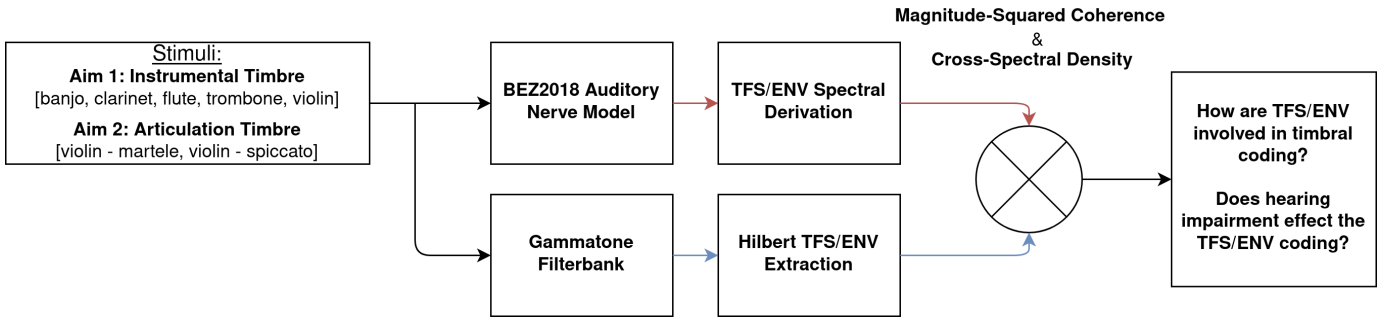


Fig. 1. Methods Flow Chart. Stimuli were passed through the BEZ2018 auditory nerve model and gammatone filterbank. The output of the nerve model (red) was analyzed by extracting the envelope component of the resulting apPSTH, $s(t)$ or fine structure component $\phi(t)$. The cross-spectral density or magnitude-squared coherence between these signals and the Hilbert envelope or temporal fine structure, respectively was computed to attempt to investigate the relevance of these features

possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

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TABLE I
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Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
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^aSample of a Table footnote.

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ACKNOWLEDGMENT

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