Modified Static Noise in Music: *Advanced Synthesis Investigation Models for Spectral Manipulation and Non-Definitive Tonality Induction*

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Introduction

About Me

- Musician (conductor and instrumentalist)
- Advanced Authentic Research
- San Francisco Conservatory of Music Pre-College
- Experience: electroacoustic music, audio processing, theory/analysis
- Focus: psychoacoustics, noise+music intersection

PROBLEM STATEMENT

- Use of non-pitched auditory stimuli (aesthetic)
- Bandpass noise ⟶ pitch impressions
- Overtone manipulation ⟶ timbre qualities
- Gap: manipulated noise for hierarchical tonality?

Goal: inform compositional tools for tonality induction

“How can static noise be utilized (using masking release techniques and overtone manipulation) to create tonal effects in music?”

The structure of music is “a product of hierarchical processing … the perceptual act of small events joining together to create larger events” (Thomson 5).

- Thomson, William. “Functional Ambiguity in Musical Structures.” Music Perception: An Interdisciplinary Journal

Literature Review

Pitch Salience

"Goodness of fit"
Overtone series

Establishes tonal center

Induction: beating, intonation

Familiarity Differentiation

Musicians:
Use dissonance to identify

Non-musicians:
Use non-tonal attributes

Psychoacoustic Induction

Combination tones

Complex tones
Built with sets of overtones

Release from masking (enhancement)

Properties of Bandpass Noise

Pitch strength

Envelope vs. fine structure

TFS important for pitch

Optimization for TFS

Pitch Salience

- Perceived “goodness of fit” based on **overtone series**
- Essential for establishing **tonal center**
- Induction: beating, overtones, intonation within context

Familiarity Differentiation

- Musicians rely on dissonance rating to identify harmonic movement

- Non-musicians rely on psychophysical and non-tonal attributes

Psychoacoustic Induction

- Combination tones (simultaneity)
  Critical bandwidth - limits

- Subjective fundamental / complex tones (association with corresponding partials)

- Masking release + binaural presentation as tools for salience

Properties of Bandpass Noise

- Pitch strength: inversely proportional to width

- Envelope vs. fine structure processing

  TFS essential for pitch intelligibility + comb. tones; basal/high-frequency prominence

- Application: optimization for TFS by maintaining 5 kHz cutoff + resolved partials

Pitch Salience

Perceived “goodness of fit” based on **overtone series**

Essential for establishing **tonal center**

Induction: beating, overtones, intonation within context

Familiarity Differentiation

Musicians rely on **dissonance rating** to identify harmonic movement

Non-musicians rely on psychophysical and **non-tonal attributes**

Application: differentiated experimental tasks utilizing psychoacoustic induction of pitch salience through manipulation of bandpass noise

Psychoacoustic Induction

Combination tones (simultaneity)
Critical bandwidth - limits

Subjective fundamental / **complex tones** (association with **corresponding partials**)

Masking release + binaural presentation as tools for **salience**

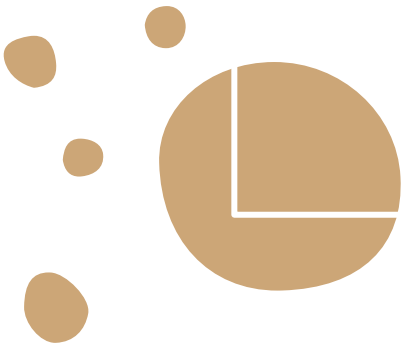
Properties of Bandpass Noise

Pitch strength: inv. proportional - width

Envelope vs. fine structure processing
TFS essential for pitch intelligibility + comb. tones; basal/high-frequency prominence

Application: optimization for TFS by maintaining 5 kHz cutoff + resolved partials

Research & Methodologies



TASK A. Harmonic Dictation

- 70 short harmonic progressions
- Superimposed on melody
- Multiple-choice by function

TASK B. Intonation Judgement

- 50 short harmonic progressions
- Forced-choice intonation judgement
- Arbitrary tones interspersed

1. COMPLEX TONES

- 4 sinusoidal complex tones
- Partials corresponding to missing fundamentals
- Chorale-style voice leading

2. CRITICAL BANDWIDTH

- Broadband noise generated for each tone
- Critical bandwidth size for each centroid

3. RELEASE FROM MASKING

- Binaural presentation
- Increased audibility
- Comodulation release

Data & Analysis

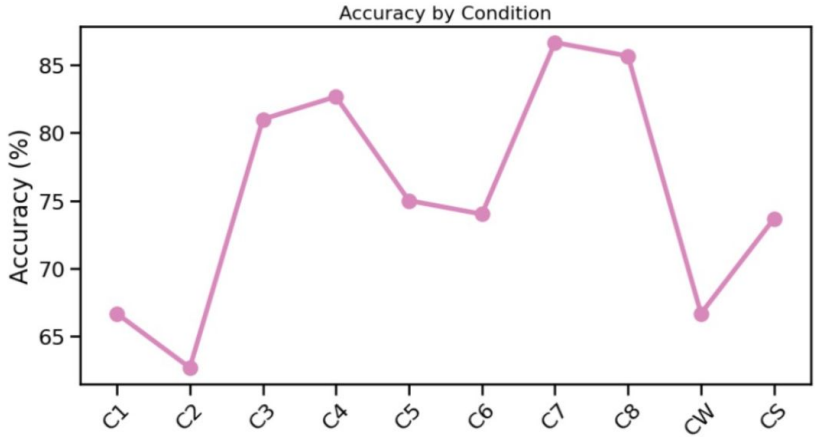


Figure 1. Results of Harmonic Task by Condition

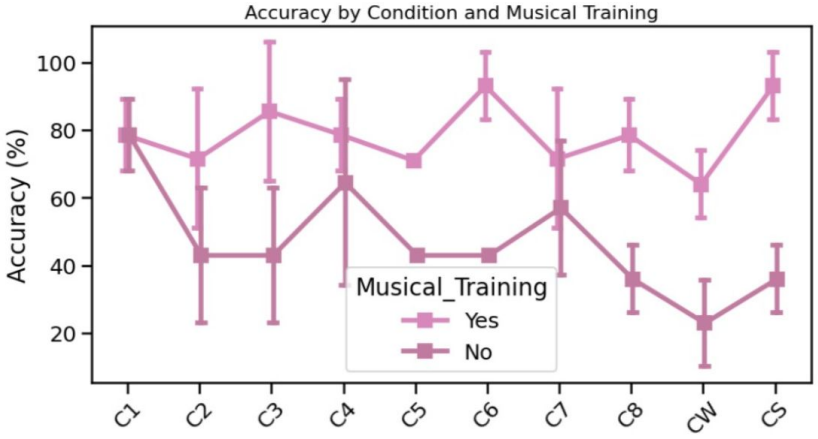


Figure 2. Results of Intonation Judgement Task.

Stimuli Features Overview

Condition	Comodulation	Binaural Unmasking	Very Audible
CW	0	0	0
CS	0	0	0
C1	0	0	0
C2	1	0	0
C3	0	1	0
C4	0	0	1
C5	1	1	0
C6	1	0	1
C7	0	1	1
C8	1	1	1

Table 1. Configuration of Stimuli

Conclusion

“How can static noise be utilized (using masking release techniques and overtone manipulation) to create tonal effects in music?”

Further application:

- Integration for auditory assistive technology (tonality induction)
- Adaptation of multi-media performance for enhanced tonal clarity
- Implementation: electroacoustic works + musical context

Further research:

- Musicians vs non-musicians trained in different cultures
- Influence of age of first musical exposure
- Effect of subjects’ particular musical experience (composers vs. instrumentalists, chamber musicians vs. soloists.)

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THANKS!

QUESTIONS?

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