Music 175: Psychoacoustics
Spring 2018
Tamara Smyth, tsmyth@ucsd.edu
[Department of Music]
[University of California, San Diego (UCSD)]
May 10, 2018

Course Information
Teaching Assistant
- Jennifer S Hou jsh088@ucsd.edu

Meeting Time and Place
Meeting Dates: 2017/4/4 - 2017/6/8

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Time</th>
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<tbody>
<tr>
<td>TuTh 12:30PM-1:50PM</td>
<td>CPSC 367</td>
<td>Smyth</td>
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<tr>
<td>Tu 2:00-3:00PM (after class)</td>
<td>CPSC 245</td>
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<td>Th 2:00-3:00PM (after class)</td>
<td>CPSC 233</td>
<td>Smyth</td>
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<td>Final project presentations</td>
<td>M 11:30AM-2:30PM (6/11/2018)</td>
<td>CPSC 367</td>
<td>NA</td>
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Course Description

Prerequisites
Music 170 or 171 (or permission by instructor).

- Week 2:
  - **Hearing**
    - *Principles of hearing* pressure, power, intensity, dB scale
    - *Pitch* the ear and how it works
    - *Loudness* phons, sones, Fletcher-Munson equal loudness curves, masking
    - Pd patches: [pitchFreq.pd] [FrequencyAndLoudness.pd] [max.pd]
    - Reading: Cook, Chapter 1 and 6.

- Week 3:
  - **Hearing in Time and Space** “cocktail party”, binaural masking, precedence effect, reverberation, localization.
  - Field trip: Audio Spatialization Lab (Spat Lab), Calit2 (April 19, 2018)
  - Reading: Cook, Chapter 8.

- Week 4:
  - **Hearing in Time and Space** (cont.)
  - **Exam 1: April 26, 2018** (Thursday, first 45 mins of class)
  - **Exam 1**: May 17, 2018 (Thursday, first 45 mins of class)
  - **Student paper presentations**

- Week 5:
  - **Cognitive Psychology and Music**
    - *Principles of perception* unconscious inference vs. direct perception (Gibson), size and loudness constancy, perceptual completion, gestalt grouping principles.
    - Reading: Cook, chapter 3.

- Week 6:
  - **Timbre**
    - *Principles of timbre* average spectral shape, formants, missing harmonics, time variation.

- Week 7:
  - **Ambiguity in Music**
    - *Auditory Illusions* ambiguity, common fate, separation with apparent motion, Shepard tones, tritone paradox
    - **Exam 2: May 17, 2018** (Thursday, first 45 minutes)
    - Reading: Cook chapter 10.
    - **Student paper presentations**

- Week 8:
  - **Pitch**
    - *Pitch Perception* place theory of pitch, repetition pitch, pitch paradox, jad, and scale.
    - Reading: Cook, chapter 5.

- **Grading**
  - 3 exams (15% each): 45%
  - 1 assigned paper presentation: 15%
  - participation and occasional assignments/experiments: 15%
  - Final project and presentation 25%

- **Required Textbooks**
  - Perry R Cook (editor). Music, Cognition, and Computerized Sound: An Introduction to Psychoacoustics (available online).
  - Brian Moore. An Introduction to the Psychology of Hearing (available online).
  - Music 175 on-line notes.

- **Important Dates**
  - **Thursday, April 26, 2018** Exam 1.
  - **Thursday, May 17, 2018** Exam 2.
  - **Thursday, June 7, 2017** Exam 3.
  - **Monday June 11, 11:30AM-2:30PM**: Final project presentations (10-15 minutes each).

- **Schedule and Online Lecture Notes (subject to change)**
  - **Week 1:**
    - Introduction to Music 175
    - **Sound**
      - What is sound? acoustics vs. psychoacoustics.
      - *Exam* time representation of sound, sinusoids, partials/overtones, harmonics.
      - *Principles* frequency representation of sound, fourier analysis, spectrograms, periodicity.
    - Pd patches: [psychoacoustics.pd] [pitchFreq.pd] [pitchAndFreq.pd]
    - Reading: Cook, Chapter 4.

  - **Week 2:**
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    - Reading: Cook, Chapter 4.
- **Week 9:**
  - **Pitch cont.**
    - Play a square wave. Describe (qualitatively) the difference you hear between the tones. The difference is the timbre (pronounced TAM-BRRR).
    - For both square and triangle waves, change the frequency of the 3rd harmonic until you no longer perceive the sound as having a clearly defined pitch (you can do this while the note plays continuously or by turning it on and off). Note the change in frequency. Is it different for each of the waveforms?
    - Reset the frequencies and select a square wave. Change the 7th harmonic until you no longer perceive a pitch. Note the change in frequency. Is it the same, more, or less than for the 3rd harmonic for the square wave in the previous step?
    - Reset frequencies and change the amplitude of the 5th harmonic until you no longer makes a difference in the perceived sound. Do you still hear the same pitch?
  - **Reading:** Cook, chapter 1 and 6.

- **Week 10:**
  - **Student paper presentations**
    - Due Tuesday April 17, 2018
      - Download [Example 1](#) and [Example 2](#) and answer the following questions.
      1. Play a square and then triangle wave. Describe (qualitatively) the difference you hear between the tones. The difference is the timbre (pronounce TAM-BRRR).
      2. For both square and triangle waves, change the frequency of the 3rd harmonic until you no longer perceive the sound as having a clearly defined pitch (you can do this while the note plays continuously or by turning it on and off). Note the change in frequency. Is it different for each of the waveforms?
      3. Reset the frequencies and select a square wave. Change the 7th harmonic until you no longer perceive a pitch. Note the change in frequency. Is it the same, more, or less than for the 3rd harmonic for the square wave in the previous step?
      4. Reset frequencies and change the amplitude of the 5th harmonic until you no longer makes a difference in the perceived sound. Do you still hear the same pitch?
  - **Reading:** Cook, chapter 1 and 6.

### Assignments

Assignments are to be submitted on TED by 12:15PM (before class) on the day they are due.

- **Week 1:**
  - **Due Tuesday April 10, 2018**
    - **Download:** [Example 1](#) and create a sine wave for which you can change the frequency.
    - **Reading:** Cook, chapter 4.
  - **Week 2:**
    - — (if you haven’t already done so, choose a paper from section Short Presentation below) and sign up for a 8-10 minute presentation. Email your selection directly to me (trumy@ucsd.edu) with subject Music 175 Short Paper Selection.
    - **Reading:** Cook, chapter 8.

- **Week 4:**
  - **Reading:** Cook, chapter 3.
  - **Week 5:**
    - **Due date TBA**
      - **Reading:** Cook, chapter 7.

- **Week 6:**
  - **Due Tuesday May 8, 2018**
    - **Final project proposal:** write a 1-2 paragraph proposal describing your project and submit on TritonEd. Once you get approval you may begin working on your project!

### Short Presentation

#### Papers Available for Selection:

- Choose a paper from references below and prepare a 18-minute paper presentation. Sign up for a time slot by the end of week 3.

#### Hearing in Time and Space


- **Pitch**
- **Timbre/Perception**

### Papers Selected:


Frequency Discrimination, and Sound Localization.”

Society of America, 90, 1889-1893.

11. Hannah M. Moir, Joseph C. Jackson and James F. C. Windmill. “Extremely high
frequency sensitivity in a ‘simple’ ear” (Hearing in moths).


Acoustical Society of America, 35, 2346-2353.

Acoustical Society of America, 40, 249.


Psychophysics, 11, 411-412.

264, 746 - 748.


Skull Vibration Enables Low-Frequency Hearing.”

22. Mirjam Kurnschultz et all. “Bat echolocation calls facilitate social communication”,
available [here]

American, 233, 39-36.