MUS 4460/6460
Post-Tonal Analysis
Math 4998/8800
Mathematical Music Theory
Spring 2015

Course Syllabus

Classroom: Standard 300
Meeting Times: T Th 2:30 – 3:45
Instructor: Drs. Mark McFarland & Mariana Montiel
Office: STD 406 & COE 708
Office Hours: T/Th 1:15-2:15 and immediately after lecture, T Th 4:30-5:30 and by appointment
Office Phone: (404) 413-5918 & (404) 413-6414
E-mail: mmcfarland@gsu.edu & mmontiel@gsu.edu

Program Description:
This course is offered as on course in a pair. This pairing is part of the Integrative Course Pairing Pilot Program of the College of Arts and Sciences. This pilot builds on the success of our First-Year Learning Communities by offering College faculty to pair two separate courses thereby expanding the notion of a “learning community” to include fully integrated instruction beyond the freshman year. For each selected course pairing, course material, instruction, and assignments will reflect the dynamic relationship between each course in the pair.

You will concurrently take Music 4460/6460 and Math 4998/8800 earning 3 credit hours for each course.

Music 4460/6460 and Math 4998/8800 will meet in STD 300 on Tuesdays at 2:30-3:45 and Langdale 305 on Thursdays. The remaining instruction in this course pair will be offered by way of web-based/distance learning instruction (see co-curricular assignments for this course).

Course Description and Objectives

Statement: This is an integrated course. For this reason, although our principal subject revolves around post-tonal music, we will approach this subject from two complementary angles: the analytical techniques used to study this music and the mathematics that serve as the theory that informs them.
Course Content

This paired course is dedicated to a detailed survey of musical practice from roughly 1880 to 2000. The goal of this class is to develop a familiarity with Neo-Riemannian theory (PLR), non-functional tonality (centricity), atonality, serialism, aleatory, sound mass composition, and minimalism through the analysis of late 19th- and 20th-Century repertoire and composition of works in these styles.

To realize these goals you must take responsibility for your own learning and participate as an active learner. The best way to master post-tonal analysis is to keep up with the course reading and course work. By the end of the semester, you will be able to recognize and analyze a variety of styles of 20th century music, and graduate students will also be able to compose three works in a variety of 20th century styles. This course will improve your skills as a performer or conductor of 20th century music since every interpretive decision is ultimately based on an analytic insight.

You will also study specific mathematical topics, for example, relevant aspects of Group Theory, Set Theory, Combinatorics, Category and Topos Theory, etc., that are used in the analysis of general objects of Music (scales, chords, rhythmic patterns) as well as in specific applications (development of software, analysis of pieces from different time periods and genres). Overarching notions, such as symmetries and patterns, will be made precise and will be illustrated, transported and analyzed in melodic, rhythmic and harmonic contexts. You will study, for example, Euclidean Rhythms.

Mathematicians will be exposed to mathematical tools and techniques that are not always covered in the core courses of the major. For example, in Group Theory you might need to study the Semi-direct or Wreath Products, and you will learn some of the basic constructions of Category and Topos Theory, such as Limits and Colimits, in the context of applications to musical analysis and of some algorithmic procedures in the software Rubato Composer. Music majors will be able to see formal aspects behind the study of postonal analysis, or the analysis of rhythm, which are not always covered in the courses of their concentrations.

Course Materials

Texts for Post Tonal Analysis

The following textbook and anthology must be purchased for Post Tonal analysis:

Roig-Francolí, *Understanding Post-Tonal Music* (Required)

Roig-Francolí, *Anthology of Post-Tonal Music* (Optional)
**Reading Material for Mathematical Music Theory:** (all reading material is provided in PDF format and posted on Desire2Learn).


Assorted articles that have been key in the development of the field of Mathematical Music Theory. These articles will come from, among other sources:

*The Journal of Mathematics and Music*
*Music Theory Online*
*Perspectives of New Music*
*Journal of Music Theory*
*Music Theory Spectrum*

Grading will be based on:

1) I in class exam and the programmed two and a half hour final exam, which are for both classes;

2) Assignments and online activities. These will include readings, group work through the blog and discussion forum on Desire2Learn, Rubato Composer computer tasks, etc.;

3) A Final Project, which includes:
   a. Taking an area of mathematics used in Mathematical Music Theory and relating it with the concrete analysis of a piece, preferably post tonal.

   b. Final original composition with not only a musical analysis but also mathematical element (this can be done using Rubato Composer or other computer generation for non-musicians)
The compositions should include “program notes” in which the ideas are explained in a non-technical way for a “general public”. The final project can be carried out in groups of at most 2, or individually.

Graduate students will be expected to play a major role in the weekly activities and final project.

The exam will be 15% of the final grade, the final exam will be 15% of the final grade, the weekly online activities, including assignments, will be 30% of the final grade, and the project will be 40% of the final grade.

\[
egin{align*}
97 - 100 &= A+ \\
93 - 97 &= A \\
90 - 92 &= A- \\
87 - 90 &= B+ \\
83 - 87 &= B \\
80 - 82 &= B- \\
77 - 79 &= C+ \\
70 - 76 &= C \\
60 - 69 &= D \\
0 - 59 &= F
\end{align*}
\]
**Integrative Course Pair: Music and Mathematics**  
**Drs. Mark McFarland (MUS 4460/6460) & Mariana Montiel (MATH 4998/8800)**  
**Culminating Assignment Rubric**

*Integrative learning is an understanding and a disposition that a student builds across the curriculum and cocurriculum, from making connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus.*

<table>
<thead>
<tr>
<th>Capstone (4)</th>
<th>Milestone (3)</th>
<th>Milestone (2)</th>
<th>Benchmark (1)</th>
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| **Connections to Experience:**  
Connects relevant experience and academic knowledge  
Meaningfully synthesizes connections among experiences outside of the formal classroom to deepen understanding of fields of study and to broaden one's own points of view.  
Effectively selects and develops examples of life experiences, drawn from a variety of contexts to illuminate concepts/theories/frameworks of fields of study.  
Compares life experiences and academic knowledge to infer differences, as well as similarities, and acknowledge perspectives other than own.  
Identifies connections between life experiences and those academic texts and ideas perceived as similar and related to own interests. |
| **Connections to Discipline:**  
Recognizes and makes connections across disciplines  
Independently creates wholes out of multiple parts (synthesizes) or draws conclusions by combining examples, facts, or theories from more than one field of study or perspective.  
Independently connects examples, facts, or theories from more than one field of study or perspective.  
When prompted, connects examples, facts, or theories from more than one field of study or perspective.  
When prompted, presents examples, facts, or theories from more than one field of study. |
| **Transfer:**  
Adapts and applies skills, abilities, theories, or methodologies gained in one discipline to the other discipline  
Adapts and applies, independently, skills, abilities, theories, or methodologies gained in one situation to new situations to solve difficult problems or explore complex issues in original ways.  
Adapts and applies skills, abilities, theories, or methodologies gained in one situation to new situations to solve problems or explore issues.  
Uses skills, abilities, theories, or methodologies gained in one situation in a new situation to contribute to understanding of problems or issues.  
Uses, in a basic way, skills, abilities, theories, or methodologies gained in one situation in a new situation. |
| **Integrated Communication:**  
Produces work that can be valued and assessed in a way that shows ability to articulate the integrated learning objectives  
Fulfills the assignment by choosing a format, language, and research in ways that enhance meaning, making clear the interdependence of language and meaning, thought, and expression.  
Fulfills the assignment by choosing a format, language, and appropriate research to explicitly connect content and form, demonstrating awareness of purpose and audience.  
Fulfills the assignment by choosing a format, language and appropriate research that connects in a basic way what is being communicated (content) with how it is said (form).  
Fulfills the assignment in an appropriate form. |
| **Music:**  
Compose an original composition complete with analysis  
Composes work and analysis that develops methodologies introduced in class to explore the material in an original light. Graphic analysis and composition performance also included.  
Fulfills the assignment to display mastery of lecture material along with graphic analysis and performance of composition  
Fulfills the assignment to display mastery of lecture material along with performance  
Fulfills the assignment in an appropriate form |
| **Mathematics:** | Students will see how the mathematical transformations, symmetries and language are actually represented in music. They will also write program notes for a general public explaining the mathematics in the music, thus showing that they can synthesize their knowledge. | Students will have read lecture material in which musicians use mathematics to analyze and compose, and mathematicians make use of music to illustrate their abstract ideas. Then they will bring these ideas to life in the compositions. | Students will show the literacy they have obtained in mathematical language by correctly writing the musical analysis in said mathematical language, both English and symbolic. | Students will see that not only science but art as well can be modeled with the universal language of mathematics, thus learning to value the need for formal definitions and logic that when, taught in an isolated manner, often appears meaningless to them. It is important to mention that the subject being modeled, i.e. music, is also often referred to as a universal language. |

*Rubric is adapted from the “Integrated Learning Value Rubric” published by the Association of American Colleges and Universities.*
Learning Outcomes:

- Students will develop a familiarity with Neo-Riemannian theory.
- Students will identify nonfunctional tonality (centricity), atonality, serialism, aleatory, sound mass composition, and minimalism through the analysis of late 19th- and 20th-Century repertoire.
- Students will identify nonfunctional tonality (centricity), atonality, serialism, aleatory, sound mass composition, and minimalism through composition of works in these styles.
- Students will learn how to approach interdisciplinary applications of the abstract knowledge they have acquired in their study Mathematics;
- Students will understand how Group Theory notions are used in Mathematical Music Theory, and will apply this understanding when carrying out analysis of musical objects;
- Students will study Group Theory constructions such as Semi-direct Product and Wreath product as well as the actual construction of Groups relevant to musical analysis, such as Julian Hook’s Signature Groups;
- Students will study concrete examples of how these constructions are applied to the analysis of post tonal music;
- Students will learn some of the basic constructions of Category and Topos Theory, such as Limits, Colimits, Subobject classifier, Functors, Natural Transformations and Yoneda’s Lemma and how they are applied in Music;
- Students will see how the Functorial approach is used in the software Rubato Composer and will learn how they can develop “rubettes” in the context of Rubato Composer.

Online Components:

SurveyMonkey: Before the lecture, you will receive an email from surveymonkey.com. These quick surveys, which are designed to be short and relatively painless will help us to specify which topics need more time devoted to them and which do not. Nota Bene: These surveys are to be completed AFTER you have read the assigned chapter for the upcoming lecture.
**Online Chat and Discussion Forums:** Discussion forums with particular subject matter will be created on Desire2Learn. D2L’s online chat can also be used when two or more people are working on a specific theme and need the instant feedback. These forums will be related to the readings and lectures, and will often include assignments which can be worked on in groups. For certain activities there will be specific coordinators; in particular, for the mathematical music theory assignments the mathematics graduate students will play a role as leaders. During the semester we will plan online chat sessions with the instructors and the class via Google+ or Skype (please sign up for a free account now at [www.google.com](http://www.google.com) and [www.skype.com](http://www.skype.com) in order to participate—we will make sure to get all of your google+ and skype names on the first night of class so that we can have our first video chat during the first week of classes). These sessions are not mandatory and count neither toward nor against your attendance score. They will be approximately an hour long and are intended to help you with the homework assignments.

**Videotaped Lecture:** We are condensing the contents of a sequence of courses, both in mathematics and in music, into the space of a single semester, so it would not be surprising if there were a point during lecture when something simply went too fast and you neglected to ask a question. For times like these, a videotape of each lecture will be placed online and you will be notified when this occurs (before the next week’s homework assignment is due). These videotaped lectures, as well as the online module, will be housed on the page devoted to our course on Desire2Learn, the multimedia portal used by GSU faculty and students.

**Missed exam policy:** There will be no makeup exams except in extreme cases that MUST be justified. Missed exams will receive a grade of zero. Any conflicts must be worked out with me ahead of time.

**Attendance policy:** Come to class on time and do not leave early. Anything else is rude and disruptive. If for any reason the University is closed on an exam or quiz day, the exam or quiz will be given at the next regularly scheduled class meeting. A student is responsible for all material covered in class, whether he or she attended the class. The instructor may drop a student from the roll for exceeding three class absences. Any student who does not complete the course for any reason must officially withdraw from the course or will be awarded a grade of F.

**Incomplete (I) Grades:** The grade of ‘I’ will be given only to students who have completed the majority of the course work and who, for a non-academic reason beyond their control, have been unable to complete the semester. See more below.
Withdrawal (W/WF): Prior to the mid-point of a grading period a student may withdraw (or be withdrawn by the instructor) and receive a grade of ‘W’. Withdrawal without penalty is not permitted following the mid-point of a grading period. The mid-point for Fall semester is Tuesday, March 3.

Failing Grades: The grading system in the Division of Graduate Studies in the College of Arts and Sciences does not include the “D.” Students must earn at least a “B” to satisfy the theory entrance requirements.

Drop Date: After the mid-point deadline (March 3), a student may apply for a hardship withdrawal through the Office of the Dean of Students.

Incompletes: From the Georgia State University Faculty Handbook:

“The grade of ‘I’ (Incomplete) may be given to a student who for nonacademic reasons beyond his or her control is unable to meet the full requirements of a course. In order to qualify for an ‘I’, a student must (a) have completed most of the major assignments of the course (generally all but one); and (b) be passing the course (aside from the assignment not completed) in the judgment of the instructor.”

Some guidelines for implementing the policy:

“A.  Student Responsibility to Notify Faculty: If the student does not contact the instructor regarding incomplete work, the student defaults on the assignment or examination. In that case, the instructor should grade the student accordingly, even if this results in a grade of ‘F’ for the course. If it is later determined that the student qualified for an ‘I’, the grade of ‘F’ can be changed to an ‘I’ in accordance with college and University policy.

B.  ‘Limited Assignment’ Criterion: If for nonacademic reasons a student has not completed one of the following, the grade of ‘I’ may be appropriate: final examination, term paper, performance requirement, laboratory assignment. If a significant proportion of the course is incomplete, the grade of ‘I’ is inappropriate.

C.  ‘Two-Week’ Criterion: An ‘I’ generally should be given only when the student fails to complete work at the very end of the term. Hence, if due dates for the assignment not completed were earlier than the last two weeks of class, or if the circumstances that caused the student not to complete the work occurred before the last two weeks of class, the student generally should not be given an ‘I’.

Academic Honesty: All students at this University are expected to engage in academic pursuits on their own with complete honesty and integrity. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University’s policy on academic honesty is published in the Faculty Affairs Handbook and the Student Handbook, On Campus, which is available to all members of the University community. The policy represents a core value of the University and all members of the University community are responsible for abiding by its tenets. Lack of knowledge of this policy is not an acceptable defense to any charge of academic dishonesty. All members of the academic community, including students, faculty, and staff, are expected to report violations of these standards of
academic conduct to the appropriate authorities. The procedures for such reporting are on file in the offices of the deans of each college, the office of the dean of students, and the office of the provost.

Accommodation for Students with Disabilities: Georgia State University complies with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Students with disabilities who seek academic accommodations must first appropriate documentation to the Office of Disability Services located in Suite 203 of the Student Center.

**Post-Tonal Analysis – Mathematical Music Theory**

**Schedule Spring 2015**

Students will be expected to have read the chapter under consideration before it is first introduced in lecture (see the schedule below)

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Primary Source</th>
<th>Relevant Examples in Music</th>
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<tbody>
<tr>
<td></td>
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<td>Cohn, Richard <em>Neo-Riemannian Operations, Parsimonious Trichords, and Their &quot;Tonnetz&quot;</em> Journal of Music Theory</td>
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Week 1: January 13, 15
Week 2: January 20, 22
Week 3: January 27, 29
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<tr>
<th>Week 4</th>
<th>February 3,5</th>
<th><strong>Continuation</strong></th>
<th><strong>Pitch Centricity and Symmetry</strong></th>
<th>Textbook Chapter 2</th>
<th><strong>Bartók</strong>: Song of the Harvest **Ponce**: Piano Sonata No. 2</th>
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<tbody>
<tr>
<td><strong>Midi Solfa Mode-Go-Round; Pitch Centricity and Composition with Motivic Cells</strong></td>
<td>Noll, Thomas <em>Theory</em>: <a href="https://sites.google.com/site/solfamodegoround/theory">https://sites.google.com/site/solfamodegoround/theory</a></td>
<td>Hook, Julian, <em>Spelled Heptachords</em>, Proceedings from Third International Conference, MCM 2011, IRCAM Textbook Chapter 1</td>
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<tr>
<th>Week 6</th>
<th>February 17,19</th>
<th><strong>Introduction to Pitch-Class Set Theory</strong></th>
<th>Textbook Chapter 3</th>
<th><strong>Schoenberg</strong>: Sech Kleine Klavierstücke</th>
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<tr>
<th>Week 7</th>
<th>February 24, 26</th>
<th><strong>Continuation</strong></th>
<th>Same as above</th>
<th><strong>Messiaen</strong>, <em>Le Collier</em></th>
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<tr>
<th>Week 8</th>
<th>March 3,5</th>
<th><strong>Continuation</strong></th>
<th><strong>MIDTERM March 3 (Post Tonal)</strong></th>
<th><strong>Webern</strong> Vier Stücke für Streichquartett</th>
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<tr>
<th>Week 9</th>
<th>March 10,12</th>
<th><strong>Analyzing Atonal Music</strong></th>
<th>Textbook Chapter 4</th>
<th><strong>Berg</strong>, Piano Sonata Op. 1</th>
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<tr>
<td><strong>Rubato Composer</strong></td>
<td>Guest Lecture Session: Dr. Guerino Mazzola. This week Math will be on Tuesday to accommodate our guest lecturer.</td>
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| March 19 | **Spring Break** | Textbook Chapter 4 | | |

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<th>Week 10</th>
<th>March 23,25</th>
<th><strong>Analyzing Atonal Music</strong></th>
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<td><strong>Rubato Composer</strong></td>
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| Spring Break | | | | |

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<tr>
<th>Week 11</th>
<th>April 6,8</th>
<th><strong>Analyzing Atonal Music</strong></th>
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<td><strong>Rubato Composer</strong></td>
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<p>| Spring Break | | | | |</p>
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<tr>
<th>Week 10</th>
<th>Maximal Evenness in Rhythm; Chains, Necklaces and Partitions; Mathematical Features for Recognizing Preference in Sub-Saharan Rhythms</th>
<th>EXAM Mathematical Music Theory</th>
<th>Ligeti: Violin Concerto</th>
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<td>March 24, 26</td>
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<td>March 31, April 2</td>
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<tr>
<th>Week 12</th>
<th>Twelve-Tone Music II: Invariance, Symmetry and Combinatoriality Hexachord Theorem</th>
<th>Textbook Chapter 8</th>
<th>Schoenberg Streichquartet #4</th>
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<td>April 7, 9</td>
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<tr>
<th>Week 13</th>
<th>Serialism: Developments after 1945</th>
<th>Textbook Chapter 9</th>
<th>Boulez, <em>Le Marteau sans Maître</em></th>
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<td>April 14, 16</td>
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<tr>
<th>Week 14</th>
<th>Project presentations</th>
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<td>April 21, 23</td>
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