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Spring 2016


Using Mathematical Research Methods to Solve a Problem in Music Theory Instruction, Specifically, the Teaching of Secondary Dominant Chords

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Ulrich, Angela, "Using Mathematical Research Methods to Solve a Problem in Music Theory Instruction, Specifically, the Teaching of Secondary Dominant Chords" (2016). *Honors Research Projects*. 305.

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Using Mathematical Research Methods to Solve a Problem in Music Theory Instruction,
Specifically, the Teaching of Secondary Dominant Chords

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Honor's Project

29 April 2016

Using Mathematical Research Methods to Solve a Problem in Music Theory Instruction,
Specifically, the Teaching of Secondary Dominant Chords

Introduction:

Many people consider mathematics and music to be at two very distant ends of the academic spectrum. I suppose this is understandable in part because of the perception of music as an artistic, right-brained discipline and mathematics as more analytic, more left-brained. Having had the opportunity to study both subjects during my time at the University of Akron, I have had the chance to discover both the artistic, exploratory side of math and the analytic, highly structured side of music. My academic journey has left me irrevocably convinced that the one discipline can certainly enrich the understanding of the other.

Some links between the two subjects are more obvious than others. Many people listen to music to help them focus while studying, and when I was in grade school, we used songs to help with some of the memorization required of early mathematics, specifically learning multiplication tables. Music students can benefit from mathematics as well, since the whole tonal system of music is based on pitches set at certain intervals relative to each other, and playing two tones together creates either a dissonant or consonant sound based on the ratio of the respective frequencies of the pitches.

My purpose here is to showcase one of the less obvious links: the study methods of each subject. I will use the mathematical model for research, discovery, and problem solving to uncover a new way to teach a difficult concept in music theory. This project will not only combine my current major (applied mathematics) and minor (piano performance), but will incorporate my future plans to teach as well.

The mathematical research process is fairly straightforward. First, the researcher needs to identify the problem to be solved. After that, a careful consideration of the available literature is in order. How has the problem been addressed before, and by whom? What were their methods, and to what level were they successful? Once these questions are answered, the

researcher can begin to formulate his or her own solution, based on the research and incorporating new ideas for improvement. Finally, some form of testing or peer review is required in order to assess the effectiveness of the new method.

In order to identify the problem I would address for this project, I reached out to a few music theory professors from the University of Akron, Dr. James Wilding and Dr. William Polanka. I was curious to hear their perspectives on what concepts music students in the early years of college theory have the most trouble with. One consistent stumbling block they were able to pinpoint is the concept, identification, and application of secondary dominant chords when performing an analysis of a work from music literature. This concept is presented at the end of Music Theory 2 and builds on all the preceding material from Music Theory 1 and 2, so in principle the students should be able to pick it up quite naturally. But somehow, putting all the pieces of the theory puzzle together is easier said than done. By examining the teaching practices of a few University of Akron professors, theory textbooks, and student reviews, I will try to combine the best elements of each to formulate my own solution to the problem.

Research and Review of Literature:

Professor Interviews:

I had the opportunity to consult further with Dr. Polanka and Dr. Wilding to get their feedback on some of the techniques they use and difficulties they encounter when teaching secondary dominant chords. Dr. Polanka, who teaches the first two semesters of theory back to back, explained how students need to have a firm grasp on the basic concepts from Theory 1 to the end of Theory 2. They should be particularly fluent in major and minor key signatures, the structure and harmonic functions of major and minor triads, and the specific roles and forms of 7th chords. When it comes time to introduce secondary dominants, he usually begins with an information sheet that lays out a step-by-step process for identifying and spelling these chords.

The overarching goal of Dr. Polanka's method is to take students from creation to identification; from using a basic algorithm and plugging and chugging their way through chord spelling exercises to developing the heuristic techniques needed to identify these chord progressions in actual sheet music. One of the main problems he has encountered is simply the time restriction placed on the subject. It usually is not introduced until the last two weeks of the semester during Theory 2, filling roughly six class periods. This might sound like a long time, but learning to think in two or more keys at once while doing a chord analysis can take a while for some students to get used to, and it is a skill they will need all throughout their next two semesters of theory.

Dr. James Wilding had a more detailed list of concepts he considers necessary to the study of secondary dominant chords: all the basics of the tonal pitch system and theory (i.e. scales, key signatures, intervals, triads, 7ths); a quick recall and identification of key signatures; knowledge of some simple aspects of the harmonic system and chord relationships; and an understanding of the Roman numeral notation system for major, minor, and 7th chords. He also highlighted the fact that learning is both an accumulative and intuitive process, and that as instructors it is possible to overload students with the accumulative side and neglect the more intuitive aspects, which can be very helpful. In the case of secondary dominant chords, Wilding suggested an intuitive introduction, such as playing a chord progression on the keyboard. See if students can identify the different sounds of the chords, and how they are functioning to enrich the harmony.

After presenting the concept of secondary dominants aurally, Dr. Wilding lays out the process of identifying and writing these chords more explicitly, and expects a certain amount of rote memorization from his students. Knowing the dominant of each note in a given key is essential, and students should be able to produce these chords on paper and in response to oral

questions on demand. Reviewing the geography of the keyboard can be very helpful with this process, since it can provide students with a visual representation of where chords lie in relation to one another. After this groundwork is laid, students can apply it to the chord analysis of real music and to harmonization exercises, in which students fill in the chords to a melody with figured bass.

Dr. Wilding agrees with Dr. Polanka in that one of the greatest inhibitors to students grasping and retaining the concept of secondary dominant chords is the time issue. After the brief introduction given at the end of Theory 2, students have all of summer break to forget everything they have learned, so when they begin Theory 3 in the fall, quite a bit of review is required before the class can move on to new concepts. This is to be expected in part with any class that spans a long holiday, and unless students determine on their own to review and keep concepts fresh, it does not seem likely to ever be completely eradicated.

The main issue students have with secondary dominant chords cannot truly be whittled down to a single problem, but both professors offered some helpful insight. On the one hand, Dr. Polanka pointed to a lack of confidence in the background knowledge required. In particular, students who are not solid on their key signatures have trouble thinking in one key, much less two, as is required when working with secondary dominant chords. On the other hand, Dr. Wilding noted a general attitude towards the study of music theory present in many current music students, that theory is anti-artistic and unnecessary for those who “just want to sing,” or “just want to play some music.” He believes that by showing students from the very start how theory acts as a key, allowing us to better understand, listen to, and appreciate music, they might stand a better chance of making it through the more difficult points.

Literature Review:

To get a better, broader picture of how secondary dominant chords have been taught in the past, I looked through several old theory textbooks to see how they approached the concept. I was interested in the goals the authors had for their texts, as well as the topics they chose to present before reaching secondary dominant chords. I also hoped to uncover some helpful tips and techniques to incorporate into my own method.

First-Year Harmony by Philip Friedheim is designed to be “read at home, and discussed in class”(Friedheim, 7). The idea is not merely to gain cognitive knowledge, but practical application skills as well. This is accomplished through discovery and the consideration of various theoretical and practical problems, with music from the classical repertoire up for examination. It is designed to go with a compatible workbook.

In this text, the ability to read and write music is assumed from the start. Secondary dominant chords are the last topic presented, after three larger sections on the history and fundamentals of the tonal system, and some elaboration on the basics including inversions, 7th and 9th chords, minor scales, and nonharmonic tones. Once secondary dominants appear, they are presented as part of an introduction to chromatic harmony, which is described as the “use of all twelve notes of the chromatic scale within any given key” (193-4).

The secondary dominant chord is described as the most common type of chromatic harmony. The author describes the function of these chords as “simple enough,” stating that any triad belonging to the key can, for a moment during the piece, take on the role of the tonic and be preceded by its dominant or dominant 7th (194). According to Friedheim, secondary dominant chords expand the harmonic possibilities at a composer’s disposal, and add richness to musical texture (194). He goes on to explain more rules for use and function, emphasizing that using secondary dominants is different from modulating, and shows several musical examples (202). The emphasis is on composition, not merely analysis.

In the preface of *A Concentrated Course in Traditional Harmony, Book 1*, author Paul Hindemith states his wish to provide a thorough yet brief study of the basics of harmony. He wants to break down the misconception that harmony is a deep, difficult, and secret language and present in plain terms the simple rules that any theory or music student should know to advance his or her study in the modern musical world. Noting the mere 125 pages of text, which include many musical examples, he certainly achieved at least one of his goals.

He begins with a brief recap of the tonal system and lists the basics of which he expects his readers to have a knowledge. He then works from the chords of principal harmony through more complex triads and harmonizations, eventually reaching secondary dominants before moving on to modulation. In one short chapter, he presents secondary dominant chords as a way to emphasize a given major or minor triad (other than the tonic) in the main key of a piece. The emphasis is provided by preceding the chord with a triad which does not belong to the main key, but serves as the dominant or leading tone triad in the key for which the chord one wishes to emphasize serves as the tonic. Following this brief description, he provides a keyboard exercise involving playing through several chord progressions involving secondary dominants in various keys, and then some music to harmonize.

To get one more perspective, I examined *Elementary Harmony, Theory and Practice* by Robert W. Ottman. This text and its accompanying workbook are meant to serve as the material for the first year of a two year music theory course, designed to give students a firm foundation in the tonal system of melody and harmony. The book covers the fundamentals of key signatures, scales, and notation first, then goes into a lengthy study of triads. Next comes elementary harmonic progression, including a study on seventh chords, before reaching secondary dominant chords.

The layout of the section on secondary dominants is very clear. It starts with a brief conceptual discussion. Then, it moves on to simple spelling and identification exercises. Finally, it ends with a quick look at how secondary dominants are actually used in music.

Student Survey:

In addition to professors and textbooks, I thought a student's perspective would be most helpful as well. I conducted a small survey amongst a few of the University of Akron School of Music students to get their feedback on how well they felt they had learned and retained their knowledge of secondary dominant chords (Ulrich, "Concept Retention").

Student A, a music education major with a focus in piano, completed Theory 2 about six semesters ago, and on a scale from 1 to 10 rated her current ability to name and spell secondary dominant chords at a 10, and was only slightly less confident in identifying them in a piece of sheet music (9 out of 10). She noted that having to consistently read and analyze scores, as a part of her major, has helped her to retain those skills. Looking back, she remembered chord spelling exercises, and then working those chord progressions out on the piano, were the exercises that helped her most in the learning process.

Student B, a vocal major, completed Theory 2 just a year ago, and also rated herself at a 10 out of 10 on chord naming and spelling. She opted for a solid 7.5 on her identification skills, stating that her ear was a bit better than her sight reading, and she could identify the progression more easily by hearing it than by seeing it. It is therefore no surprise that her favorite exercises from Theory 2 were those that involved reading along with score to audio accompaniment and analyzing the harmony and chord progressions in that way.

Student C, who started as a piano major and switched to Multiple Disciplinary Studies in Communication and Music, took Theory 2 closer to 2 years ago. She too gave herself a 10 on her ability to name and spell secondary dominants on command, but only a 7 on identifying those chords in music. Since she does not need to analyze as much sheet music in her current

major, she stated the skills might be a little rusty, but was sure that with a little brain power they would come back quickly enough. When she was enrolled in Theory 2, she recalls finding the chord spelling and score analysis exercises the most helpful, since her ear was not the best!

After examining the procedures and perspectives offered by educators and students alike, I arrived at several conclusions. First, instructors must be willing to play the long game in order to help their students understand secondary dominant chords. Take the time to solidify basic concepts, and encourage the students who get stuck on the “when will I use this?” question. Second, when presenting the concept for the first time, integrate various types of examples so students can see, hear, and start to understand how the chords function in the context of the harmonic system with which they are already familiar. Similarly, when it comes time to apply the knowledge, provide a range of different exercises, including reading, writing, listening to, and playing secondary dominant chords. This should give every student his or her best chance of grasping and retaining this key component of music theory.

Unit Design:

After walking through this brief literature review, the next step in the math research method is to take what I have learned, both the good and the bad, and attempt to formulate my own solution. I will structure my solution in the form of a unit plan, designed for use in a college level theory classroom. My unit will break down into three main sections: the explanation, the algorithm, and the application. For cohesion, there will be elements of intuitive and accumulative learning throughout, along with visual, physical, aural, and oral examples to aid students of every learning type. The goal is to provide students with a solid basis of knowledge and understanding at the end of Theory 2 in order to make the review process at the beginning of Theory 3 as painless as possible.

Explanation:

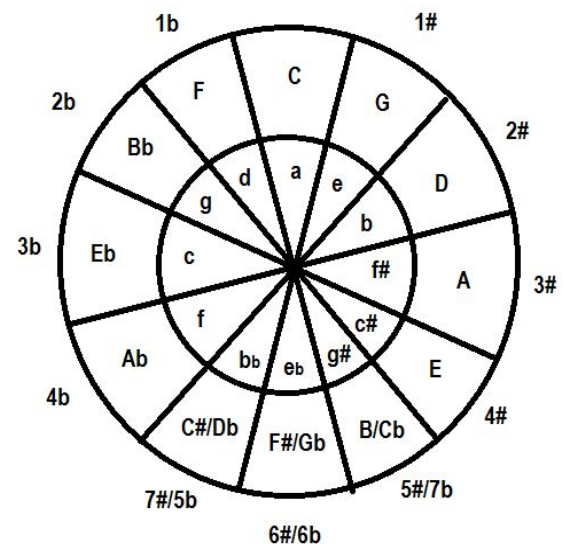
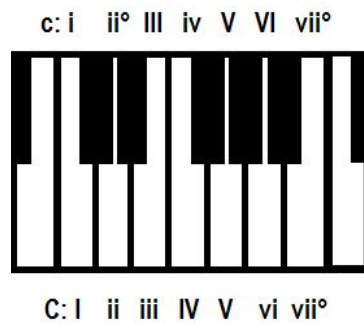
Begin the discussion of secondary dominant chords and their harmonic functions by presenting auditory examples in current music and from classical repertoire. Depending on available technology, these examples can range from CD and YouTube audio clips to playing chord progressions on a keyboard. Accompany the listening examples with visual counterparts in the form of score segments, so students can see what they are listening to. This will help them continue to build correlations between what they see when analyzing a piece of sheet music and what they actually hear when the music is performed.

After giving the examples, provide a handout and explanation of the basic harmonic, compositional, and analytical functions of secondary dominant chords. Include explicit examples of how, why, and when they are used to enrich harmonic texture. Once students have a better idea of what they are looking and listening for, present the listening examples again to help solidify the concept.

Algorithm:

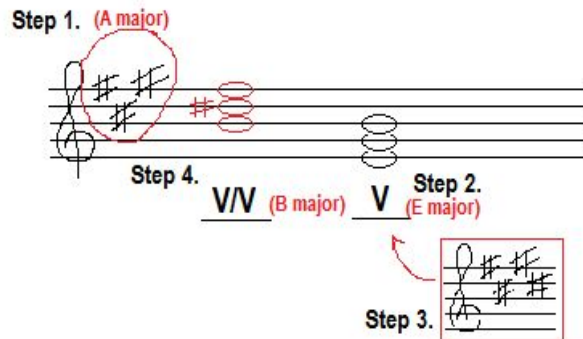
Once the conceptual base has been laid, help the students to form a toolbox of information they will need to identify and build secondary dominant chords effectively. The list of “need-to-knows” includes key signatures, the relationships between notes in a key (i.e. which is tonic, dominant, subdominant, etc...), how to construct triads and leading tone chords within a key signature, and the Roman Numeral system for

identifying those triads. An example cheat sheet might include the circle of fifths and drawing of a keyboard with the Roman numeral labels laid out for a given key, as shown:



After reminding them of basic tools they will be using, lay out the step by step algorithm for constructing a secondary dominant chord. For example:

1. Identify home key
2. Identify the triad which belongs to home key that the secondary dominant will be leading to
3. Identify the key and key signature where that triad acts as the tonic
4. Identify and build the dominant or seventh chord of that key in that key signature



Follow this immediately with an example of how this process works, and some basic exercises so they can put it into practice. Chord identification and spelling exercises are a great place to start. Then, students can try playing the chord progressions on the keyboard to get a feel for how this type of harmonic progression actually sounds. After the students get comfortable with these types of activities, have them harmonize some basic melodies with secondary dominants in preparation for the final phase of the unit, the application.

Application:

When transitioning from rudimentary exercises to dealing with real music, begin by helping students recognize some intuitive cues for identifying secondary dominant chords during chord analysis. Have them look for raised chromatic pitches, which can indicate out-of-key triads. When assigning chord analyses of sheet music from the classical repertoire, be sure to provide accompanying audio tracks so they can use both their ears and their eyes to identify the harmonic progressions. They can further apply this knowledge by writing short, four bar melodies and harmonizing them using secondary dominants. By reading, writing, and hearing the chords, students should begin developing a solid basis of understanding that will last them through the summer, into Theory 3, and beyond.

Assessment:

The final step in the mathematical model of research and problem solving is to test whether or not the problem was actually solved. Does the new solution “work”? How can the effectiveness be qualitatively measured? The goal of teaching is for the student to retain the information presented and be able to apply it, thus I propose three distinct methods of testing.

First, standard testing and quizzing procedures should be used after the material is introduced using my method at the end of Theory 2. Does the three step process of explanation, algorithm, and application lead to scores at least on par with past methods? Second, a survey could be provided for instructors at the beginning of Theory 3 to get their feedback in the following areas: how many class periods were required to review secondary dominants (expected amount or different), and what aspects of the topic required the most review (explanation, algorithm, or application). Finally, a student survey similar to the one used in this project could be issued to juniors in various departments in the School of Music (performance, education, etc...) who had been taught using this method. Questions would include how comfortable they felt identifying (visually or aurally) and spelling secondary dominant chords, and which exercises/ techniques helped them most during their time in the theory courses.

Conclusion:

I began this research project with the main goal of incorporating my three main academic pursuits: mathematics, music, and education. By using the mathematical research method to investigate a fresh way to teach a difficult concept in music theory, I have mostly achieved this aim, yet I end here on a half-cadence, to borrow the phrase. I have examined past procedures, gotten feedback from current students and teachers, and developed my solution, but it is all academic until it is tested. Though I have proposed a possible method for testing, it might take some time before an opportunity arises in which my methods can be tried in a music theory classroom. However, the idea of a multi-faceted approach to teaching has been verified time

and again by human nature itself. Each student is unique, benefiting from different methods of instruction and bringing something different and valuable to the learning experience as well.

Each student is worth it, and if I can smooth out the concept presentation and algorithmic parts of the process to pave the way for understanding and application, then my job is done.

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