CS Capstone Problem Statement

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Interactive Music Theory App

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Abstract

Our project will be the creation of a mobile application (iPhone and Android) that helps beginner and intermediate students learn and develop new perspectives on music theory. The application also aims to be a useful reference for more experienced musicians. The challenge is to present the core ideas of music theory in such a way that beginners can immediately use them to begin composing their own musical chord progressions. This means presenting the concepts of intervals (specifically 5^{th}s), notes and note names, the circle of 5^{th}s, chords, as well as some basic patterns for creating their own chord progressions.

These can be presented by offering miniature lessons with explanations for each concept, interactive visualizations that allow students to ask and answer questions about how the theory relates to itself, the ability to compose music within the application and have the application verify that the music follows the composition rules, and lastly challenges and games that help drill the students to put the concepts into their memory.

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1 PROBLEM

Music theory is a myriad of ideas, thoughts, notations, and lenses with which to analyze music. Currently, if you are a beginner in the world of music theory, the idea of composing or understanding the music you play and listen to is a Herculean task. Most discussions of music theory assume that you know the fundamentals, but picking out which parts of music theory ARE the fundamentals is itself difficult. There are thousands of resources that claim to teach the fundamentals of music, but a big issue is that many of these present information that is unnecessarily complex or altogether not important. Even though there are manners of teaching the fundamentals that are simple enough that children as young as 8 years old can pick it up within a week, these methods get lost in the confusion of all of the rest of music theory. On top of this, in order to be learned, these methods need to be applied by students as they are taught. Students need to synthesize and compose their own music to stretch and solidify their understanding. Typically this means a teacher would be necessary to facilitate the student's learning but our application will aim to teach this method on its own.

The method itself starts with a small core, and from there can be built upon in layers. The core of the method is based on an interval between two pitches called a 5^{th}. Because of the natural harmony between the pitch frequencies of the notes in a 5^{th}, the interval sounds very strongly connected in our ears. By following the intervals of 5^{th}s up or down, we walk through all of the notes in Western music, arriving at the note we started at several octaves up or down. An octave is an interval that is so strongly connected in our ears that we perceive it as the same note. Since these 5^{th}s circle around all of the notes back to the starting note, we call this the circle of 5^{th}s.

Notes in a major scale can be determined from the circle of 5^{th}s by taking a specific subset of the adjacent notes of the tonic note you are looking at. These notes, and their ordering are used in the first method of composition. For example, the notes in C major scale are, BEADGCF (in this order). Compositions can be formed by following 3 rules:

1) Chords descend (go from left to right) by one step at a time.
2) Chords can ascend (go from right to left) by one or more steps at a time, but cannot go up by one consecutively.
3) The center of gravity is the tonic (C major, in this example).

An example composition in C major might be: G Em Am Dm G C F G C

The main problem our group is facing is to present this core method of teaching music theory to a user in a clean an understandable manner.

2 SOLUTION

In order to present this method of teaching to beginners of music theory, we will be creating an interactive mobile application (iPhone and Android). At minimum, the app will present information about intervals, have an interactive visualization of the circle of 5^{th}s, and present the method of composition outlined above. Interactive visuals of strings vibrating at different frequencies can be used to teach students about intervals. Students can interact with the ratio of frequencies between strings and can choose different interesting musical intervals to learn more about how intervals work. Note names will be displayed to help solidify new notations.

The circle of 5^{th}s will be displayed in two ways simultaneously. The traditional circle will be displayed, and can be spun around by students to see different notes at the top. On the side, a vertical listing of the circle of fifths will be shown, with a window showing which notes are a part of the major scale. This window can be dragged up or down, which will spin the circle of fifths at the same time. The student will have the option to show/hide relative minor keys and parallel keys within the circle graphic as well.

Students will be able to view the rules of composition outlined above. In order to stretch their understanding, they can enter in their own chord sequences and have the application check whether or not their chord sequence matches the rules.

There were other ideas for the application that were under discussion, but not yet nailed down.

- Allow users to play their compositions audibly
- Allow for In-app purchases of course packs
- Challenges to help students recognize when the rules of composition are being followed
- Different methods of composition
- Saving compositions
- More chord types including inversions/voicings, 7ths, etc.
- Combine keys to extend the number of chords in the original composition
- Lessons on secondary dominants

3 PERFORMANCE METRICS

The performance metrics are very minimal. Lukas, the client, wants to take an iterative approach to developing the application. He has lots of ideas for layers that he can add, but at the core he has the following requirements with each of thier respective metrics:

- Deployable to the iPhone or Android store

  The application must be working in the same versoin on both platfroms meaning if bugs arise spesfic to one platform these issues must dealt with

  The application must be avaiable on andriod application store

  The application must be available on the iPhone application store
- Displays the circle of 5^{th}s in the two ways outlined above

  The circle should display the relitave notes within the given key provided by the selected note at the top of the circle.

  The circle should be interactive. Being able to spin to allow the user to select differnt keys.

  The circle "'page" should also contain a verticle listing of the notes within the chosen key.

  Adjusting this verticle list should spin the circle.

  The circle "page" should also contain an option to display parrallel, and relitave keys within the circle.

  Stretch- the parralell and relitive keys would also be displayed next to the virticle listing.
- Displays the method of composition described above

  Some form of composition input would be created

  Some form of AI or testing algoritym would determine if the users input composition follows the rules of compoosition.
- Some futher metrics for strech goals might be

  The application must make user compositions audible

  The application must contain challenges to help students test and measure their comprehension of music theory

  The application must allow users to save compositions

  The application must contain lessons on ussing parralell and relitave keys to combine keys and extend the number of chords in the original composition

  The application must contain lessons on secondary dominants

  The application must allow for In-app purchases of course packs which might include;

  Creating and implemeting different methods of composition

  More chord types including inversions/voicings, 7ths, etc.

  Lessons on ussing parralell and relitave keys to combine keys and extend the number of chords in the original composition

  Lessons on secondary dominants