Music Game: Simple Approach to Teach Music

Stephen H. Choi
Georgia Institute of Technology
heejoong@gatech.edu
770-871-8914

Ellen Do
Georgia Institute of Technology

ABSTRACT
In this paper we describe MusicGame, a flash game to help people understand the general music theory. Though the music game boom has struck the game industry for the last couple of years, no single game has been proven to be effective in teaching actual music. MusicGame tried to solve this problem by incorporating musical elements such as pitch and intervals in the game. The preliminary user study shows that there is a great potential to be an effective learning tool to teach music theory.

Author Keywords
Music, Game, Education.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
In the last couple of years, music games have gained a huge success and popularity. It is because many people love music, and there was never a game that could satisfy their needs in the system. Now that there are many games out there people should have a better and fun way to explore music. Unfortunately, that is not the case. Being good at one of those games do not necessarily make players a better musician. In this paper, it explains why most games have failed to teach music, what elements are needed, introduce “Music Game” and how it works, and finally show preliminary user test results.

RELATED WORKS
Over the last ten or so years, there has been a great number of games developed that are related to music. Most of the games are made in a way that it can be played with a limited number of buttons or controls; hence, trying to simulate the actual instruments or plays. In 1997, Konami have developed beatmania [1], one of the very first so-called rhythm games in the world. It consists of 5 keys that look like a piano keyboard and a turntable, and also provided a fundamental element, the falling note, which we see in modern music games. The success of beatmania led Konami to many other music games, such as Dance Dance Revolution, DrumMania, and GuitarFreaks [2]. Later, DrumMania and GuitarFreaks became the inspiration for GuitarHero and RockBand.

All of these games have misleading concept overlaid in their titles. Though they claim to incorporate both elements of music and game, it does not relate to actual music itself. The only connection between these games and music is the beat-matching which is performing certain action at a certain time to get the correct note.

Of course, there are some other music games that tried something other than just beat-matching. For instance Keyboardmania [3], another product by Konami, uses 24-key keyboard which allows users to play the genuine instrument; however, scrolling note display limits the capability of learning how to play the piano. WiiMusic tried to explore a new area of music game by making users to improvise rather than keeping up the beat. It provides various ways to play a single song by choosing different instruments, jamming with other players, and playing in different genres; however, WiiMusic is not too much different from other music games. In other words, being good at those games will not make players a better musician. To learn about music, it should consist of elements of music in it.

ELEMENTS OF MUSIC
Music has many different elements, and the most prominent of which are: rhythm, melody, and harmony. If it lacks of any of these elements, then we cannot call it music.

Rhythm
Rhythm, in musical terms, is the arrangement of sounds and silences in time. In simple term, it is a beat. The time signature or meter signature informs how many beats are in a measure. In most of rhythm games, they displayed rhythm by the speed of scroll and distance or closeness between two notes. Though rhythm is one of the key elements of music, MusicGame is aimed to tackle other problems which were never dealt in other music games.
**Melody**
A melody is a series of notes sounding in succession. The notes of a melody are typically created with respect to pitch systems such as scales or modes.

**Pitch**
Pitch is a subjective sensation, reflecting generally the lowness or highness of a sound. In musical context, some people have perfect pitch or an absolute pitch which is the ability to identify or recreate an isolated musical note to its place without benefit of an external reference. This is not something you can learn by practice. However, people can develop relative pitch which is the ability to identify the intervals between given tones. This skill is essential professional skill to be able to play with others.

**Harmony**
Harmony is the use of two or more simultaneous pitches. Vertical sonority refers to considering the relationships between pitches that occur together; usually this means at the same time, although harmony can also be implied by a melody that outlines a harmonic structure.

**Intervals**
An interval is the relationship between two separate musical pitches. For example, in the melody "Twinkle Twinkle Little Star", the first two notes (the first "twinkle") and the second two notes (the second "twinkle") are at the interval of one fifth. What this means is that if the first two notes were the pitch "C", the second two notes would be the pitch "G"—four scale notes, or seven chromatic notes (P5), above it. See Table 1 for more detail. Therefore, the combination of specific intervals creates harmony.

**DESIGN**
One of the biggest reasons why people do not learn anything from playing music games is that they have left out many musical elements that were mentioned above. So in this game, it is designed to include those possible elements in to it. Since the goal of playing this game is to learn music and able to improve your musical skills, it was decided to leave out the rhythm aspect. Rather, this game will focus on how to read music notes and understand the concept of intervals. Also, making it interesting and simple is the key aspect to this game—as the rhythm games have.

**Reading Music**
The basic step for learning music is to read music or musical sheet. For a given musical staff, the vertical placement of the note depicts the pitch of the note. The note value indicates the relative duration of the note. There are great numbers of information represented in a single music sheet other than notes; however, at this stage of the development, it would be plenty enough to only deal with notes on a treble clef from C4 to E5 for the beginners who do not have any musical background.

<table>
<thead>
<tr>
<th>Number of semitones</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Perfect Unison (P1)</td>
</tr>
<tr>
<td>1</td>
<td>Minor second (m2)</td>
</tr>
<tr>
<td>2</td>
<td>Major second (M2)</td>
</tr>
<tr>
<td>3</td>
<td>Minor third (m3)</td>
</tr>
<tr>
<td>4</td>
<td>Major third (M3)</td>
</tr>
<tr>
<td>5</td>
<td>Perfect fourth (P4)</td>
</tr>
<tr>
<td>6</td>
<td>Augmented fourth (aug4)</td>
</tr>
<tr>
<td>7</td>
<td>Perfect fifth (P5)</td>
</tr>
<tr>
<td>8</td>
<td>Minor sixth (m6)</td>
</tr>
<tr>
<td>9</td>
<td>Major sixth (M6)</td>
</tr>
<tr>
<td>10</td>
<td>Minor seventh (m7)</td>
</tr>
<tr>
<td>11</td>
<td>Major seventh (M7)</td>
</tr>
<tr>
<td>12</td>
<td>Perfect octave (P8)</td>
</tr>
</tbody>
</table>

Table 1. Table of intervals.

The game will display a random note from a range of C4 to E5, and then wait for an input to match the note. When a random note is displayed, it will play the sound of the note accordingly. Depending on the level the player chooses, the time count will be different. It will wait 5 seconds for the input for an easy level, 3 seconds for medium level, and 2 seconds for hard level. The hard level also does not display the note on the screen, which forces the player to test their perfect pitch skill. For each level, there will be a set of ten questions.

**Understanding Intervals**
Once the players get used to reading notes, it is time to understand the intervals. Interval is the distance between two pitches; however, for people to get used to the idea of intervals, MusicGame always uses the C4 note for the relative pitch. The games will display random interval ranging from P1 to P8, and the player will input the second note to match the interval. The same principle rule applies to the interval part. 3 seconds for easy level, 2 seconds for medium level without visual display for hard level, and 2 seconds without visual display and texture display for hard level. The reason for a shorter amount of time is because the interval session is supposed to be run after the player is able to read the music. For each level, there will be a set of ten questions as well.
IMPLEMENTATION
The whole game was based on two fundamental elements—music and game. Learning and playing music and, at the same time, it is supposed to be fun and entertaining. One of the simplest games we can find is what are so-called the flash games. It is named after a design tool which allows people to create animations and websites fast and easy. The key characteristics of flash games are simple and fun. A game like Kutar [4] is a great example, where the only control the player needs to do is a simple mouse click. The fun part is that player will be challenged to correctly input with decreasing time limit. In other words, the player will be asked to do a simple task in a faster way every time. This approach seemed like a great design choice to fit the purpose of MusicGame and started developing in flash.

To simulate the actual piano keyboard, I have chosen to use the computer keyboard characters: ‘z’, ‘s’, ‘x’, ‘c’, ‘v’, ‘g’, ‘b’, ‘h’, ‘n’, ‘j’, ‘m’, ‘k’, ‘‘, ‘l’, ‘’, ‘;’, and ‘/’ to map note C4 to E5 respectably. See Figure 1 for more detail.

PRELIMINARY USER TESTING
After a prototype was developed, three people were asked to play the game. One of the players has played for an extended amount of time, whereas other two simply tried it for 10 to 15 minutes. All three participants had a certain amount of knowledge in music theory and were able to read music.

The general feedback I have received was that the mapping of computer keyboard to piano keyboard was not straightforward and hard to get used to. It was originally designed to have the Note Easy level to count only 3 seconds, and people had hard to time just to find the right key on the keyboard though they knew what note was supposed to be played.

However, the one player who played over an extended amount of time got used to it and was able to get questions right for averaging more than 80% of the time. This results show that once the player gets used to the computer keyboard, the players can actually learn how to read music and understand intervals.

FUTURE WORK
MusicGame has great potential to be an effective tool to teach music theory. Currently it limits the contents to reading note and understanding intervals. Therefore, the next step will be to incorporate rhythm and melody elements into the game so that people can actually learn a song rather than practice on single element.

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