Math and music theory assignment

Art & Culture

Ellyn McCall MFG-1107 Term Report 11/7/2011 Mathematics and Music Theory In the study of mathematics, at first glance it seems clear that mathematics is cut and dry, black and white, completely numerical. But in many ways, mathematics extends into other areas of life. While some people may think of mathematics and art as being two separate entities, Math is very present in many artistic endeavors. Music, commonly referred to as an art, would not be possible without the relationship it shares with mathematics. In many different ways, math is an important part of music theory.

One way that math and music theory are intertwined is within a theory of mathematics called Geometrical Music Theory. Clifton Callender, Ian Quinn, and Dmitri Tymoczko, who attended Florida State, Yale, and Princeton Universities respectively, created this method of music analyzing. Geometrical music theory is based on the mathematics locked within the structure of music. Their theory is based on their research that shows that " musical operations, such as transpositions, can be expressed as symmetries of n-dimensional space (Geometrical Music Theory, par. 3). Scales, chords, and rhythms can all be categorized into mathematical ' families'. Different geometrical spaces are created by different types of categorization. Using this method, researchers can analyze more types of music more effectively and show the changes in music over time in a straightforward manner. In it's simplest iteration, geometrical music theory provides a unified framework to decode musical events that are presented differently but are similar in nature. The creators believe that this theory can be used to compare different types of music to find underlying mathematic similarities or differences.

In this way, those viewing the geometric sequences can see the visual difference between different genres and eras of music. It could one day also be possible to eventually show visual representations of music at a concert or recital. When pitch is examined, mathematics appears once again. Wave frequencies between pitches are created by sound waves moving the air. As these sound waves move, higher and lower areas of air pressure are created, and the frequency pockets of air enter your ear translates into the pitch that is heard.

Generally, notes with higher pitches have higher corresponding frequencies and notes with lower pitches have lower corresponding frequencies. Higher frequencies mean that air pockets arrive more frequently while with low frequencies, air pockets arrive more slowly. For example, the note middle C translates to air pockets arriving every 0. 00382 seconds while the note middle G, which is higher than middle C, translates into air pockets arriving every 0. 00255 seconds. Both of these notes are depicted below. Additionally, notes that are one octave higher or lower also have corresponding frequencies.

Middle C has a frequency that is exactly half that of High C, and Middle C's frequency is twice that of Low C. Playing these notes together is pleasing to the ear because all the air pockets fit together in a way that form a pattern. Other notes also have patterns of air pocket distribution, and the way that these air pockets correspond translates into whether notes sound good or sound discordant to the ear. This is the way that musical harmony is formed. Mathematics is what dictates whether notes and their frequencies will sound good or bad together.

The equal tempering ratio is a good guide to determine what notes will sound pleasing to the ear when played together. Another mathematical principle of music is the key it is played in. Musicians can alter a song by playing it in many different keys. The key of a song raises or lowers all the notes in a song by the same amount. Key changes are done for many reasons. Sometimes a particular key fits one instrument better than another, or a singers voice is better suited to a higher or lower key than a song was originally written in. While musician’s can change keys effortlessly and without thought, there is a large amount of athematics behind the music. While music and mathematics are worlds apart at first glance, there is a strong underlying structure of mathematics, even though it’s invisible to the casual observer. As in many areas of life, a strong thread of mathematics makes music work. Webliography Website Description: Math and Music URL: http://www. math. niu. edu/~rusin/uses-math/music/ Evaluation: The website Math and Music is a great tool that explains how math factors into the theory behind music. There is a large amount of information displayed in a user-friendly format.

Website Description: Geometrical Music Theory URL: http://plus. maths. org/content/geometrical-music-theory Evaluation: This website studies the relationship between music theory and geometry in easily understood language. It relates the results of ongoing studies into these causal relationships. Website Description: The Magical Mathematics of Music URL:

http://plus. maths. org/content/os/issue35/features/rosenthal/index

Evaluation: This website explores the relationship between math and pitch, math and musical tone, and math and different keys of music. It’s very interesting to read.