Contributions to Music (Beauty in Music)

by a student in MUS 207

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Beauty is a topic that would seem to be beyond the reach of scientific inquiry. However, a number of individuals have made important discoveries that have shed some light on this elusive topic and aided in the creation of art that is widely considered to be beautiful. The topic of music is a particularly interesting realm of human creation that embodies the growth of our understanding of beauty. From the simple yet divine Gregorian plainchants of the Middle Ages to the harmonically rich compositions of the 18th century to the sonically invigorating electronic compositions of the present day, it is apparent that the human conception of beauty within music has evolved. Given the subjective nature of music and beauty, it is impossible to peg down an exact definition of what classifies something as a piece of "beautiful music." That being said, through the exploration of the work of five individuals who devoted themselves to expanding our conception of beauty in music, we are able to get a better picture of why a certain piece of music may elicit a sense of beauty and how that may change over time.

The building block of any piece of music is a single musical tone. Hermann Helmholtz, who will be discussed at greater lengths later, described a musical tone as being a series of rapid vibrations in the air that "recur with perfect regularity and in precisely equal times." Although a single musical tone produced by a well-designed instrument can indeed sound pleasing, one quickly realizes that the true beauty of music is revealed when these individual tones begin to mingle with each other at various pitches over a period of time. The individual who is generally credited with having uncovered a relationship between pitches of pleasing musical tones is Pythagoras. He determined that a resonating string that was half the length of another would produce a pitch that was an

octave higher. When the ratio of the lengths of the two strings was changed to be 3:2, an interval of a perfect fifth was produced. When the ratio of the lengths of strings was 4:3, an interval of a perfect fourth was produced. All of these intervals are called consonances and are generally described as having a pleasing sound when heard in context of each other. It was from these ratios that Pythagoras was able to develop a seven-note scale called the Pythagorean scale that was built up of perfect fifths stacked on top of each other in order to create a succession of tones starting from a single note ranging to an octave above. Thus by relating music notes to simple numerical relationships, a method for tuning instruments and a system for arranging musical notes that sound pleasing in context to each other was created.

Two thousand years later a French Philosopher named Marin Mersenne became interested in exploring the relationship between human rational and the beauty in music. This interest lead him to pursue a goal of being able to reveal an even deeper explanation of beauty in music and he even proposed the idea of being able to create the ideal piece of music through this knowledge. Mersenne wanted to determine which of the Pythagorean consonances were the most beautiful and why. He published a series of books called *Traité De L'Harmonie Universelle*, an exploration of harmony through the perspective of poetry, taste, astronomy, physics, math and spirituality in the search of this rational and reason. It was through these explorations and correspondence with some of the leading mathematicians and scientists of the day that began to expose the true mysterious nature of beauty within music. In response to Mersenne's questions regarding which consonances could be considered most beautiful, Descartes advised him of the variable nature of the perception of beauty from person to person; this letter was published in

Marin Mersenne on Language and Music. "Although everyone knows that honey is sweeter than olives, many people nevertheless prefer eating olives to honey. Likewise, everyone knows that the fifth is sweeter than the fourth, the latter than the major third, and the minor; and yet there are places where the minor third pleases more than the fifth, where even a dissonance will be found more agreeable than a consonance." Mersenne's inability to discover an ultimate order behind beauty in music is actually a very important discovery in itself and is a step towards the realization of an art form that is equally able to evolve in different directions, as it is to provide an experience of beauty. Also his extensive exploration and correspondence with other important individuals helped him to put compile and publish some important laws including the rate of vibration of a string in relation to its tension and length, the speed of sound and some ideas that helped in the creation of the 12-tone scale as we know in today.

Hermann Helmholtz who studied during the 19th century had a unique approach to exploring the human experience of beauty because he was interested in looking at both the physics of musical sound as well as the human perception of that sound. Helmholtz felt that looking at beauty in music from a physiological approach was particularly valid due to the fact that "the sensation of tone (is) the material of the art;" as he described in his book *On the Sensations of Tone as a Physiological Basis for the Theory of Music*. In this same publication Helmholtz describes a musical tone as consisting of upper partials and explains how the human ear is able to break down all incoming sound information in such a way that allows it to accurately perceive all the subtleties of a musical tone (although this is mainly unconscious). He also explained what happens when two tones interact with each other in a medium and described a phenomenon called beats that

occurs when the pitch of these tones is not consonance. In his book of popular lectures, Helmholtz described these beats as appearing harshest when the "two tones differ by about a semitone," and the harshness becoming less as the two tones becoming further apart. He also talks about how when tones at greater intervals, such a perfect fifth, are not exactly at a 3:2 pitch ratio, beats can be created by their upper partials and a harshness will result. This knowledge is important because it shows that the human ear perceives sound in quite a predictable way. Helmholtz proved scientifically why some tones, when combined, will sound harsher than others and why the tones laid out by Pythagoras work together scientifically. What is not predictable is the perception of beauty that arises from experiencing music that contains either consonant tones or dissonant ones. Through his work, Helmholtz initiated the development of the whole field of psychoacoustics and revealed why musical tones sound the way they do to the human ear in context of each other.

The history of music composition up until the 20th century saw a great progression in the development of harmony with the use of dissonance becoming increasingly acceptable. Composer Steve Reich sought to explore a different approach to the composition of music and succeeded through the creation of a style called phasing. The effect of phasing in Reich's compositions can be compared to the beats that are created by two musical tones at slightly different pitches, except instead of the waveforms of the musical notes "beating" against each other, in phasing, short melodic phrases "beat" against each other as they fall out of sync when repeated at slightly different tempos. The effect of this is quite similar to the way one experiences harmonic dissonance and when listening to it for the first time it feels unnatural, that is until the two phrases eventually

converge upon each other resulting in a feeling of relief. Brian Eno describes Reich's phasing as "transferring the job of the composer to the brain of the listener" given the fact that the input material is relatively simple, but the combined effect is complex. Reich is a modern day example of how a concept in music that at first is perceived as unpleasant sounding and widely disapproved of, can grow in public acceptance and eventually become considered to be a part of the beauty of a certain musical piece. Just as harmonic dissonance has grown in it's use and is now perceived as giving more meaning and beauty to the sounds of consonances, the melodic chaos in sections of Reich's phasing pieces can give meaning and beauty to a simple melodic phrase when it stabilizes.

Although the 12-tone scale provides composers with a musical palette for the creation of harmonically rich and beautiful music, it did have some limitations that had to be compromised for in the form of the equal-tempered tuning system. Most composers have had no qualms about this limitation and have gone on to compose beautiful and moving music. Others have sought to escape from the confines of the black & white keys. Morton Subotnick was one of these individuals. He took advantage of technological advancement and with the help of Dan Buchla created a new musical instrument called the Buchla modular synthesizer. One of the biggest advantages of this new instrument was that it was not stuck in any single tuning, in fact, the whole point of it's design was to force the user to create music in a totally new way. He was commissioned to compose and record an album called "Silver Apples of the Moon" which was the first piece of music for synthesizer. The score for these pieces look more like abstract geometric sketches than they do written music, and indeed the result is a sound that is completely unique to the music world at the time. As with the compositions of Reich, upon the first

listen these synthesized pieces of music can sound unnatural and maybe even disturbing, but as one grows more accustomed to the sound they may begin to find that the blips and whizzes slowly bring them into a new realm of musical enjoyment and experience of beauty. The use of synthesizers in music has exploded since that point of time and has established itself as a force in music that shows no sign of leaving soon. Although his method of composition that abandoned the use of the 12-tone scale in favor of more experimental tone arrangements has been slow to make its way into popular use in music, he has definitely made a clear point that this is not a requirement in the creation of beautiful and enjoyable music.

The history of western music has seen a profound evolution in the style of composition and overall sound of the music. Pythagoras and Helmholtz showed that there is indeed an underlying reason as to why certain combinations of musical tones are considered to be more "agreeable" to the ear and that this explanation lies both in the physics of the sound and in the ear of listener. However, this rational is not ultimate and through the quest for the ultimate beauty in music Mersenne found that the experience of beauty really lies within the listener. Composers such as Reich and Subotnick are modern day examples of how the perception of beauty in music is always shifting; by approaching the creation of music in a unique way they were able to create something truly unique that pushed listeners to reevaluate their idea of an experience of beauty in music. All music is bound by the fact that tones at certain ratios will create beats that sound dissonant, whether or not that is beautiful is up to the listener and what was considered ugly one day may very well be considered beautiful the next.

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