

An Overview of Music Theory and Sound Healing

Sentics

Manfred Clynes is a leading researcher in music and emotions. Using a device of his own invention Clynes documented that human emotion has distinct wave forms called “essentic waves”. He also noted that universal human emotions have the same essentic wave form characteristics no matter what culture they are from. Healing music using essentic forms calls for the musician to “feel” an emotion and then to express this emotion through the sounds being made. Through visualization the sound healing practitioner can help the person being worked on experience emotions they wish to work with. From a performance perspective, according to Tom Kenyon, the ability of a musician to impart emotional content into a performance can possibly also be what distinguishes performances by “master” musicians performing the same piece of music as someone else (this can also be said why the same performer can sound completely different on two different performance of the same piece of music).

Musical Intervals

An interval in musical theory is the difference in pitch between two notes.

Intervals are based on two notes being considered; for example the interval between a C and a G is a fifth (C,D,E,F,G is a distance of 5 notes). In addition to the number of tones between notes, the nature of the interval can also be described. In a major scale, intervals starting from the tonic can be perfect or major. A Unison is the interval between a note and itself. In the minor scale we have perfect and minor intervals.

Musical Modes

Western music, for the most part, since the time of Bach and the establishment of equal temperament, is primarily harmonic in nature. Melodies are drawn primarily from the major and minor

scales that we will be looking at below. However this wasn't always the case.

Music of ancient was modal in nature. In modal music harmony plays a very small part while melody is predominant. This was due to the fact that non-equal tempered systems were used in the past, and each musical mode had a very distinct quality. Even in equal temperament the musical modes have distinctive qualities that distinguish them from each other. As an introduction to a further discussion on temperament in Western and Non-Western music we will have a brief introduction to the modes.

Modal music is based on a drone, a continual pitch that sounds throughout the piece. This acts as a point of reference for everything that follows, a home base that the musician returns to after a flight of improvisation. The effect of the drone is that sustained the low frequency tones cause the body and all the muscles to relax due to entrainment, or becoming 'in sync' with the music.

The main thing to listen for as I play these modes is the half steps and where they occur. As you will notice the placement of whole and half steps is what will distinguish one mode from another.

There are two ways of looking at modes, as parallel modes or as relative modes. Below are relative modes. In relative modes the notes all remain the same and the mode is changed by changing root notes. In relative modes the same notes are always used but the root note changes.

Musical Entrainment

Forced Vibrations lead to a phenomena called entrainment. If you have two vibrating objects with the same natural frequency or corresponding harmonic, they will both have a forced vibration affect on each other. This process, given time, normally leads to a condition where the both objects automatically synchronize. Once complete synchronization has occurred both oscillators are able to vibrate with less energy.

Western Music Theory

The Western Musical alphabet consists of 12 notes, A, A#, B, C, C#, D, D#, E, F, F#, G, and G#.

The Major Scale

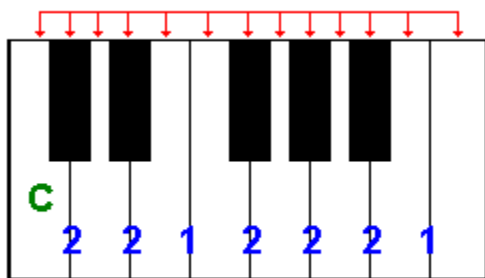
Western Music Theory starts with the Major Scale. This is a diatonic (7 note) scale that begins again on its' eighth note. For ease of example it is typical to use the Key of C Major.

In this key melodically the scale looks like this:

| | | | | | | | |
|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|
| C | D | E | F | G | A | B | C |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Do | Re | Mi | Fa | Sol | La | Ti | Do |

In the C major scale (as well as all major scales) the half steps occur between the third and fourth and seventh and eighth notes of the scale. In Western Music the position of the whole (whole tone) and half steps (semi tone) changes the tonal character of the scale or mode as they are sometimes referred. In this scale the notes all occur on the white keys of the piano and therefore is a “natural” major scale, meaning there are no sharps or flats in this scale.

1 Semi-Tone Interval between each Note



Semi-Tone intervals between White Notes

The Minor Scale

The minor scale is another diatonic scale that is the other predominant scale in Western Music as well as theory. In the Key of C it looks like this:

| | | | | | | | |
|-----------|-----------|----------------------|-----------|------------|----------------------|----------------------|-----------|
| C | D | E_b | F | G | A_b | B_b | C |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Do | Re | Mi | Fa | Sol | La | Ti | Do |

Looking at this scale we see there are half steps between the 2nd and 3rd and 5th and 6th notes of the scale.

The Modes

| Mode | Notes | Explanation |
|-------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ionian | C, D, E, F, G, A, B, C | This is also the basic major scale, the half steps occur between the 3rd and 4th, and 7th and 8th steps |
| Dorian | D, E, F, G, A, B, C, D | Minor derivative, half steps between 2nd and 3rd, and 6th and 7th steps |
| Phrygian | E, F, G, A, B, C, D, E | Minor derivative, half steps between the 1st and 2nd and 6th and 7th steps |
| Lydian | F, G, A, B, C, D, E, F | Major derivative, half steps between 4th and 5th, and 7th and 8th steps |
| Mixolydian | G, A, B, C, D, E, F, G | Major derivative, half steps between 3rd and 4th, and 6th and 7th steps |
| Aeolian | A, B, C, D, E, F, G, A | This is also the basic minor scale, half |

| | | |
|----------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | steps between the 2 nd and 3 rd and 5 th and 6 th |
| Locrian | B, C, D, E, F, G, A, B | This is a diminished type scale, the half steps fall between the 1st and 2nd and 5th and 6th steps |

In parallel modes the same root notes is always used. Below are the notes in parallel modes in the key of C.

| Mode | Notes | Explanation |
|-------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ionian | C, D, E, F, G, A, B, C | This is also the basic major scale, the half steps occur between the 3rd and 4th, and 7th and 8th steps |
| Dorian | C, D, Eb, F, G, A, Bb, C | Minor derivative, half steps between 2nd and 3rd, and 6th and 7th steps |
| Phrygian | C, Db, Eb, F, G, Ab, Bb, C | Minor derivative, half steps between the 1st and 2nd and 6th and 7th steps |
| Lydian | C, D, E, F#, G, A, B, C | Major derivative, half steps between 4th and 5th, and 7th and 8th steps |
| Mixolydian | C, D, E, F, G, A, Bb, C | Major derivative, half steps between 3rd and 4th, and 6th and 7th steps |
| Aeolian | C, D, Eb, F, G, Ab, Bb, C | This is also the basic minor scale, half steps between the 2nd and 3rd and 5th and 6th |
| Locrian | C, Db, Eb, F, G, Ab, Bb, C | This is a diminished type scale, the half steps fall between the |

| | | |
|--|--|------------------------------------------------------------------------------------------|
| | | 1st and 2nd and 5th and 6th steps |
|--|--|------------------------------------------------------------------------------------------|

Pentatonic Scales

Folk music in most cultures is based on a five note scale (pentatonic). There are two widely used pentatonic scales, the minor pentatonic and the major pentatonic.

**The *minor pentatonic* utilizes five of the seven notes from the minor scale. They are (in the Key of C):
C Eb F G Bb**

So it is the minor scale with the 2nd and 6th scale degrees omitted.

The *major pentatonic* omits the 4th and 7th scale degrees of the major scale.

C E F A B

The Harmonic Series

The harmonic series is a series of “harmonics” or “overtones” which sound together at the same time to create the note that is sounding.

We will look at the first sixteen harmonics from the harmonic series and examine how these intervals relate to the fundamental pitch.

The Monochord used for demonstration has two bridges 100cm apart, on the next page is a chart with the note of harmonic, ratio of the harmonic, where the nodal point is, and what interval the harmonic sounds in relation to the fundamental, which is in the case of my instrument a D.

| Harmonic | Ratio | Node Point | Interval |
|----------|----------------|------------|---------------------|
| 1 | Fundamental | Open | |
| 2 | $\frac{1}{2}$ | 50 | Octave |
| 3 | $\frac{1}{3}$ | 33.33 | 5th |
| 4 | $\frac{1}{4}$ | 25 | octave |
| 5 | $\frac{1}{5}$ | 20 | M3 |
| 6 | $\frac{1}{6}$ | 16.66 | 5 th (2) |
| 7 | $\frac{1}{7}$ | 14.28 | m7th |
| 8 | $\frac{1}{8}$ | 12.5 | Octave |
| 9 | $\frac{1}{9}$ | 11.11 | M2nd |
| 10 | $\frac{1}{10}$ | 10 | M3 |
| 11 | $\frac{1}{11}$ | 9.09 | Raised 4th |
| 12 | $\frac{1}{12}$ | 8.33 | 5th |
| 13 | $\frac{1}{13}$ | 7.69 | Flat 6th |
| 14 | $\frac{1}{14}$ | 7.14 | m7th |
| 15 | $\frac{1}{15}$ | 6.66 | M7 |
| 16 | $\frac{1}{16}$ | 6.25 | Octave |

Musical Temperament

Above we looked at the Harmonic Series and the harmonics that it consists of. Now we will be looking at how music temperament and scales relate to this system. Music temperament is “the tuning of an instrument, that is determining the exact pitches to be sounded. Since pitch also depends on frequency, differences in tuning are

created by differences in frequency.” The most prevalent temperaments in Western Music have been the Pythagorean System, Just Intonation, the Mean Tone System, and, since 1780, Equal Temperament. Understanding temperament systems is a very complex undertaking but below we will look at the basics of the different systems and briefly discuss the advantages and disadvantages of the different systems.

Just Intonation

There are quite a number of ways of looking at how intervals are generated from the harmonic series, which is how just intonation, and to a lesser degree the Pythagorean systems work. For just intonation Graham Breed explains intervals in terms of “adding intervals”, *“Adding intervals means multiplying frequency ratios. So, adding a major and minor third gives $6/5 * 5/4 = 3/2$, a fifth. A fourth is the difference between a fifth and an octave, so $2/(3/2) = 4/3$. A tone is the difference between a fourth and fifth. $(3/2)/(4/3) = 9/8$. But, a major third is two tones. $9/8 * 9/8$ is not $5/4$. So, there are two different tones in just intonation. $9/8$ is a major tone, and a minor tone is $10/9$. That comes from $(5/4)/(9/8) = (10/9)$.”* Pitch can also be looked at in a mathematical way (which I’m not versed in this method well enough to explain) by which *“Scientists have devised a standard unit for measuring the size of perceived intervals resulting from two frequencies vibrating at a given ratio. This unit is called a cent because it equals 1/100th of a half step. A half step is the smallest interval between two notes on the piano. There are 12 half steps in an octave, and so one octave = 1200 cents. This means that all of our normal intervals on the modern piano are divisible by 100 cents. For example, what musicians call a*

half-step (C up to Db) = 100 cents
whole step (C to D) = 200 cents
minor third (C to Eb) = 300 cents
major third (C to E) = 400 cents
perfect fourth (C to F) = 500 cents
augmented fourth (diminished fifth, C to F#) = 600 cents

perfect fifth (C to G) = 700 cents
minor sixth (C to Ab) = 800 cents etc.

There is a rather complicated formula for figuring out how many cents large an interval is:

Divide 1200 by the logarithm of 2.

***If you use base 10 logarithms (any base is permitted),
1200/log 2 = 3986.3137...***

***For any ratio n/p,
the number of cents in the interval is***

log (n/p) x 1200/log 2

***If you're using log 10, then
cents = log (n/p) x 3986.3137..." Kyle Gann***

David Cartright puts it this way; "One way to understand Just Intonation is in terms of the harmonic series; every interval used in Just Intonation can be found somewhere in the harmonic series. By definition, the harmonic series is that sequence of frequencies which is all whole-number multiples of any particular fundamental frequency. Thus, since any just interval is expressible as a frequency ratio of two whole numbers, that interval is also the interval between those same two harmonics. For example, the ratio 7/5 is the interval from the fifth harmonic to the seventh. So by becoming familiar with the harmonic series as a musical scale, one also comes to know all the just intervals included. (To put it in strictly numerical terms, a familiarity with the whole numbers also includes a familiarity with the proportions of whole numbers, i.e., the rational numbers.)"

If we look at the harmonic series and the difference in intervals of the series from the chart earlier, and listen to the intervals from the monochord, we can begin to see the practical basis for this.

Below is a chart of the pitches:

| Note | Ratio (or harmonics) | Interval (from fundamental) |
|-------------|-----------------------------|------------------------------------|
| C | 1/1 | Root |
| C# | 16/15 | m2 |
| D | 9/8 | M2 |
| D# | 6/5 | m3 |
| E | 5/4 | M3 |
| F | 4/3 | P4 |
| F# | 45/32 | +4 |
| G | 3/2 | P5 |
| Ab | 8/5 | m6 |
| A | 5/3 | M6 |
| Bb | 9/5 | m7 |
| B | 15/8 | M7 |
| C | 2/1 | Octave |

The above chart shows the intervals in relation to the fundamental. By careful examination and by listening to different notes you will see that there are many other possibilities for these same intervals

in the harmonic series. For instance the major second purely from the harmonic series is slightly different from the 2nd to the 3rd harmonic then from the 2nd to the 1st harmonic. There are a number of other differences as such. What this then gives the musician or composer is a number of different ways to play similar intervals. This is how the Indian and Middle Eastern systems of music have what is referred to in Western Music Theory as 'microtones'. These musicians (as well as some Western musicians) will pick the size of the intervals based on the type of 'scale' they are playing.

Musical Terms

Drone- sustained pitches against which a melody is set

Frequency- a physical quantity equal to the number of events in a given time. In music, this means the rate at which an instrument vibrates, measured in cycles per second or Hz.

Harmonic Series- the entire series of notes produced by a vibrating material, string, or air column. Although only a single tone can usually be distinguished (that produced by vibrations along the whole length of the string or air column), smaller portions of the total length are also vibrating, producing different, much softer notes called overtones or partials.

Monochord- a single string stretched over a sound box, with the strings held taut by pegs or weights on either end, most of our current knowledge of the instrument is of its use by Pythagoras as early around the 6th century BC for scientific research on the nature of sound.

Pitch- the number of vibrations per second of a musical sound

Temperament- the tuning of an instrument, that is determining the exact pitches to be sounded. Since pitch also depends on frequency, differences in tuning are created by differences in frequency.