Music Theory: A Very Brief Introduction

I. Pitch

A. Equal Temperament

For the last few centuries, western composers usually have relied on the division of the musical spectrum into octaves, each of which is divided into twelve equally-spaced pitches of the chromatic scale, called the equal-tempered scale.

We take equal temperament for granted now, but in fact it has been the standard in western music for only 200 years or so.

B. Tonality

Tonality is the way sound usually is organized in the west to produce music. Tonal music is music in which the chords and harmonies are arranged to give the strong feeling that the piece has a certain pitch that is its “home base.” The organizing principle of tonal music is the relationship of the twelve pitches in the scale with the “home base,” that one particular pitch called the tonal center or tonic. The tonal center is the same as the musical key.

In a simple piece, the tonal center usually is easy to identify – frequently it is the pitch at the end of a melody (and possibly the beginning as well), as in “Row, Row, Row Your Boat” shown below.
When a pitch has been chosen as the tonal center, the key of C for example, then certain other pitches tend to support this tonic – they all gravitate back to the tonal center in the course of the melody. *This sets up a hierarchy of pitches, with some being more important than others.* The set of important pitches is called a **scale**. One such scale – the C major scale – is shown below. The C major scale includes all the white keys on a piano keyboard.

![C major scale](image)

A melody written using a particular scale usually will include only the notes in this scale. For example, “Row, Row, Row Your Boat,” which is in C major, only includes notes in the C major scale.

![Row, Row, Row Your Boat](image)

The “Row, Row, Row Your Boat” example is extremely simple, because only one note is being played at a time. It can be made more interesting by playing several pitches simultaneously, producing **chords**. A little zest can be added by changing the chords, as in the example below, again “Row, Row, Row Your Boat,” in which we briefly switch from a C major to a G\(_7\) chord near the end.

![Chords](image)
Chords that sound pleasant to our ears are said to be **consonant**; those that don’t sound as pleasant are **dissonant**.

![Dissonant and Consonant Intervals](image)

Along with the melody, the chords also reinforce the tonal center by creating tension and release in the course of a composition. As a piece moves away from the tonic or includes dissonant chords, the sound become more dissonant and builds up tension; as it returns to the tonic or they become more consonant, we feel release.

Why does this all matter to us? One reason is that we need to understand what is meant by “atonal” and “twelve-tone” music.

**C. Atonal and Twelve-Tone Music**

Atonal music is, of course, not tonal. Atonal music does not use the tonal hierarchies that characterized the sound of earlier western classical music. An atonal composition does not have a tonal center and tries to avoid melodies and harmonies that will make the piece sound tonal, so it may sound dissonant and even jarring to classically-trained ears. Often we are left feeling tense or on edge when it is through. Classical music became more and more atonal over a period of time during the latter part of the 19th and the early 20th century. Today, it often is associated with a particular method of composition called **twelve-tone music** – the music of Schoenberg, Webern, and Berg in particular.

Twelve-tone music does not set up a hierarchy of pitches, some which are more important than others. **Instead, all twelve pitches in an octave are assumed to be equally important and are arranged in a particular order that the composer chooses.** This ordering of pitches is called the **tone row**. As an example, the tone row for Webern’s *Concerto for Nine Instruments* to which we listen on the first day, is shown below.

![Twelve-Tone Row](image)

The premise of the twelve-tone method is that the tone row will be repeated or transformed to produce a composition. Once a note has been used, it cannot be used again until the other pitches have occurred. As just one example of an allowed transformation, Webern’s tone row can be reversed in order.
It also can be transposed by moving all notes up or down by a given set of intervals or turned upside down in the octave (inverted). The reversals, transpositions, and inversions can be done again and again at the composer’s discretion. The best way to keep track of this is to number the notes and transform them mathematically – something we definitely don’t want to get into here. Suffice it to say that twelve-tone, sometimes called serial, composition is exacting and difficult. Because it is not tonal, some also find it to be a difficult listening experience.

D. Modal Music

Modal music is based on modes rather than scales. A mode isn’t much different from a scale, since it lists the notes that are “allowed” in the piece of music and defines the note that the piece should end on. In fact, one of the medieval church modes is the same as a major scale and another the same as a minor. Modes often sound different than scales, though, because the intervals between notes are different from the major or minor scales characteristic of tonal music.

Modal jazz, which was pioneered by Miles Davis and John Coltrane, was an important development in the Sixties. These musicians based their new music on the allowed pitches in a mode rather than on the chord sequence of any particular song, and thus were not compelled to follow a melody or chord sequence that gravitates toward a tonal center. They also had greater freedom to use any note in the mode – even pitches that would be dissonant and not used in the chord structure of a tonal piece. Modal jazz is fairly easy to recognize by listening to the chords played by the pianist – Bill Evans in “So What,” for example. If the piano chords don’t change much throughout the piece, then it is modal.

Modal jazz pieces are a step backward from tonal music in one sense because they generally use a very simple harmonic background, often just a few repeated chords. Modal jazz is a step forward for soloists, though, because the static background allows them greater freedom to improvise: if they are not forced to follow a set chord structure that gravitates toward a tonal center, then soloists have a much wider choice of pitches to play.

E. Just Temperament

The equal tempered scale that is used by the piano keyboard is not the only possible one and actually is a compromise that was made as keyboard instruments were developed a couple of hundred years ago.

To help understand tuning scales, we need to remember that sounds are produced in a piano or a string instrument by vibrating strings and that the frequency of the vibration determines the pitch of the sound – the higher the frequency, the higher the pitch. An octave is determined by two notes, one of which has a frequency two times as fast as the other. For instance, the frequency of C’ on the keyboard shown above is twice the frequency of C. We say that the interval between these two notes has the ratio 2:1 because this is the ratio of their frequencies.
Notes that are an octave apart (that is, with a 2:1 interval) commonly are considered to be consonant, because they sound pleasant. Other smaller intervals (6:5, 5:4, 4:3, 3:2, 8:5, and 5:3) also are consonant.

One might assume that it would be best to tune a piano so that its pitches exactly correspond to these perfectly consonant intervals. This in fact is a historically important tuning scale, the Just Scale. This method of tuning is not used much today, though, because an instrument tuned in one particular key using the Just Scale can sound bad when the composition changes keys – many of the intervals no longer are consonant in the new key.

The Equal Temperament Scale, which divides the octave up into twelve equal semitones, is a compromise that solves this problem. Although none of the intervals in the Equal Tempered scale are perfectly consonant, none are very far from perfect either, and in fact are close enough to sound good. The small sacrifice in perfection of the intervals is more than compensated for by the fact that a piano tuned according the Equal Temperament scale sounds equally good in all keys.

II. Duration

Notes and silences (rests) last for specified lengths of time that depend on their duration and on the tempo of the piece.

Note durations are specified as fractions of a whole note. For example, two half notes take up as much time as one whole note.

The length of a whole note depends on a piece’s tempo.
III. Dynamics

Dynamics describes the loudness of the music. The dynamics of a section of a piece is denoted by Italian symbols, *forte* (*f*) for loud and *piano* (*p*) for soft. Multiple symbols multiply the effect. For example, *ff* means very loud and *fff* means very, very loud.

As an example, the five-bar piece shown at the right gradually grows louder and then softer again.

Dynamics is relative, because the actual loudness and softness of a piece depends on the instrument or instruments playing. A sound played *fortissimo* (*ff*) by a flute will not be as loud as that played *fortissimo* by an entire orchestra.

IV. Timbre

The timbre (pronounced “TAM-ber”) or color of music describes the aspects of a sound that do not involve pitch, dynamics, or duration. The timbre of a sound includes all the qualities that allow us to distinguish different musical instruments. Because the timbre of their sounds are so different, it is easy to distinguish between a saxophone and a trumpet, even if they are playing exactly the same pitch with exactly the same loudness.

Different musical instruments have different timbres because their notes are combinations of sound waves of different frequencies, called harmonics. The number of harmonics present, and their intensity, determines the color of the sound. Usually, sounds with a large number of harmonics are more interesting.

As an example, the sound spectrum of a trombone playing the same pitch but increasing the dynamics of the note from soft to loud is shown below:
The harmonics that combine to give the total sound we hear are plotted as horizontal lines, with their frequencies displayed on the y-axis. Notice that when the sound is soft, few harmonics are present, but as the loudness increases, the importance of the upper harmonics also increases. The presence of many harmonics, especially those in the upper range, is what gives a trombone the “brassy” sound when played loudly.

V. Sound Envelope

The sound envelope (or volume envelope) is a plot of how loudness varies with time, which sometimes is called its volume envelope. The sound envelope has three phases – attack, sustain, and decay.

- The attack: the period in which the loudness of the sound is rising.
- The sustain: the period in which the loudness is relatively constant.
- The decay: the period in which the loudness is decreasing.

Sound envelopes for three different sounds are shown at the right. How do the three sounds differ in their attack, sustain, and decay phases?

Because, as we saw with the trombone example above, timbre depends on loudness, there is a corresponding timbre envelope. The timbre envelope is very complex because of the many harmonics, which decay at different rates. The timbre envelope at the right shows the rise and fall of the first twenty harmonics in a trumpet tone.
Digital samplers and synthesizers use a related sound envelope model, called “ADSR,” for attack, delay, sustain, release.

This envelope model uses “decay” to describe the fall-off of the sound after the initial attack and “release” for the final fading out of the sound after it has been sustained.
References


10. “Dynamics in Music,” http://cnx.rice.edu/content/m11649/latest/


