Music Fundamentals

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WHAT IS MUSIC?

Music moves through time; it is not static. In order to appreciate music we must remember what sounds happened, and anticipate what sounds might come next. Most of us would agree that not all sounds are music! Examples of sounds not typically thought of as music include noises such as alarm sirens, dogs barking, coughing, the rumble of heating and cooling systems, and the like. But, why? One might say that these noises lack many of the qualities that we typically associate with music.

We can define **music** as the intentional organization of sounds in time by andfor human beings. Though not the only way to define music, this definition uses several concepts important to understandings of music around the world. "Sounds in time" is the most essential aspect of the definition. Music is distinguished from many of the other arts by its temporal quality; its sounds unfold over and through time, rather than being glimpsed in a moment, so to speak. They are also perceptions of the ear rather than the eye and thus difficult to ignore; as one can do by closing his or her eyes to avoid seeing something. It is more difficult for us to close our ears. Sound moves through time in waves. A sound wave is generated when an object vibrates within some medium like air or water. When the wave is received by our ears it triggers an effect known as sound, as can be seen in the following diagram:

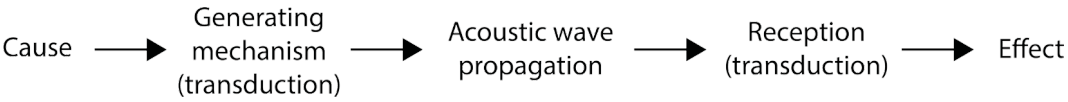

Figure 1.1 | Movement of a sound wave
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As humans, we also tend to be interested in music that has a plan, in other words, music that has intentional organization. Most of us would not associate coughing or sneezing or unintentionally resting our hand on a keyboard as the creation of music. Although we may never know exactly what any songwriter or composer meant by a song, most people think that the sounds of music must show at least a degree of intentional foresight.

A final aspect of the definition is its focus on humanity. Bird calls may sound like music to us; generally the barking of dogs and hum of a heating unit do not. In each of these cases, though, the sounds are produced by animals or inanimate objects, rather than by human beings; therefore the focus of this text will only be on sounds produced by humans.

Acoustics

Acoustics is essentially "the science of sound." It investigates how sound is produced and behaves, elements that are essential for the correct design of music rehearsal spaces and performance venues. Acoustics is also essential for the design and manufacture of musical instruments. The word itself derives from the Greek word *acoustikos* which means "of hearing." People who work in the field of acoustics generally fall into one of two groups: **Acousticians,** those who study the theory and science of acoustics, and **acoustical engineers,** those who work in the area of acoustic technology. This technology ranges from the design of rooms, such as classrooms, theatres, arenas, and stadiums, to devices such as microphones, speakers, and sound generating synthesizers, to the design of musical instruments like strings, keyboards, woodwinds, brass, and percussion.

Sound and Sound Waves

As early as the sixth century BCE (500 years before the birth of Christ), Pythagoras reasoned that strings of different lengths could create harmonious (pleasant) sounds (or tones) when played together if their lengths were related by certain ratios. Concurrent sounds in ratios of two to three, three to four, four to five, etc. are said to be harmonious. Those not related by harmonious ratios are generally referred to as **noise**. About 200 years after Pythagoras, Aristotle (384-322 BCE) described how sound moves through the air—like the ripples that occur when we drop a pebble in a pool of water—in what we now call waves. **Sound** is basically the mechanical movement of an audible pressure wave through a solid, liquid, or gas. In physiology and psychology, sound is further defined as the recognition of the vibration caused by that movement. **Sound waves** are the rapid movements back and forth of a vibrating medium—the gas, water, or solid—that has been made to vibrate.

Properties of Sound: Pitch

Another element that we tend to look for in music is what we call "definite pitch." A definite **pitch** is a tone that is composed of an organized sound wave. A note of definite pitch is one in which the listener can easily discern the pitch. For instance, notes produced by a trumpet or piano are of definite pitch. An indefinite pitch is one that consists of a less organized wave and tends to be perceived by the listener as **noise**. Examples are notes produced by percussion instruments such as a snare drum.

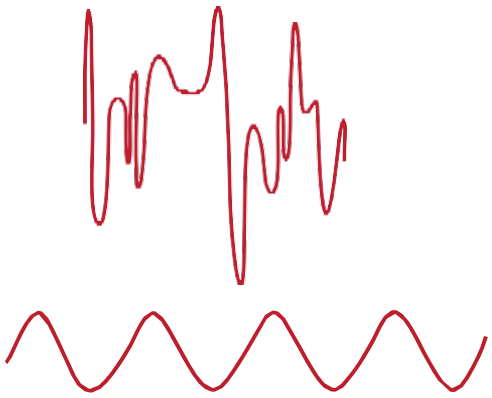

Figure 1.2 | Two sound waves, the first an indefinite pitch and the second a definite pitch.
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Numerous types of music have a combination of definite pitches, such as those produced by keyboard and wind instruments, and indefinite pitches, such as those produced by percussion instruments. That said, most tunes, are composed of definite pitches, and, as we will see, melody is a key aspect of what most people hear as music.

The sound waves of definite pitches may come in many frequencies.

Frequency refers to the repetitions of a wave pattern over time and is normally measured in **Hertz** or **cycles per second (cps)**. Humans normally detect types of sound called musical tones when the vibrations range from about twenty vibrations per second (anything slower sounds like a bunch of clicks) to about 20,000 vibrations per second (anything faster is too high for humans to hear.) Watch the first five minutes of this excellent explanation of how different types of sounds result from the combination of the **partials** above the basic tone. In actuality, all sounds result from different variations of this process, as it naturally occurs in our environment.

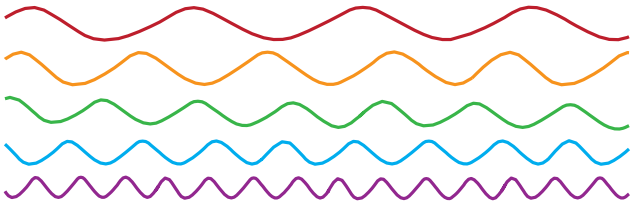

Figure 1.3 | Sine waves of varying frequencies
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~~**Ex. 1.1: The Audio Kitchen, Sawtooth and Square Waves (2012)**~~

~~http://www.youtube.com/watch?v=A1gwC8YoyMU~~

In the Western world, musicians generally refer to definite pitches by the "musical alphabet." The musical alphabet consists of the letters A-G, repeated over and over again (...ABCDEFGABCDEFGABCDEFG...), as can be seen from this illustration of the notes on a keyboard. These notes correspond to a particular frequency of the sound wave. A pitch with a sound wave that vibrates 440 times each second, for example, is what most musicians would hear as an A above middle C. (Middle C simply refers to the note C that is located in the middle of the piano keyboard.) As you can see, each white key on the keyboard is assigned a particular note, each of which is named after the letters A through G. Halfway between these notes are black keys, which sound the sharp and flat notes used in Western music. This pattern is repeated up and down the entire keyboard.

SIDEBAR: How Waves Behave

Reflection – sound waves reflect off of hard surfaces

Absorption – sound waves are absorbed by porous surfaces

Amplitude – refers to how high a wave appears on an oscilloscope; i.e., how much energy it has and therefore how loud it is

Frequency – refers to how many times a wave vibrates each second. This vibrating speed is measured using cycles per second (cps) or the more modern Hertz (Hz)

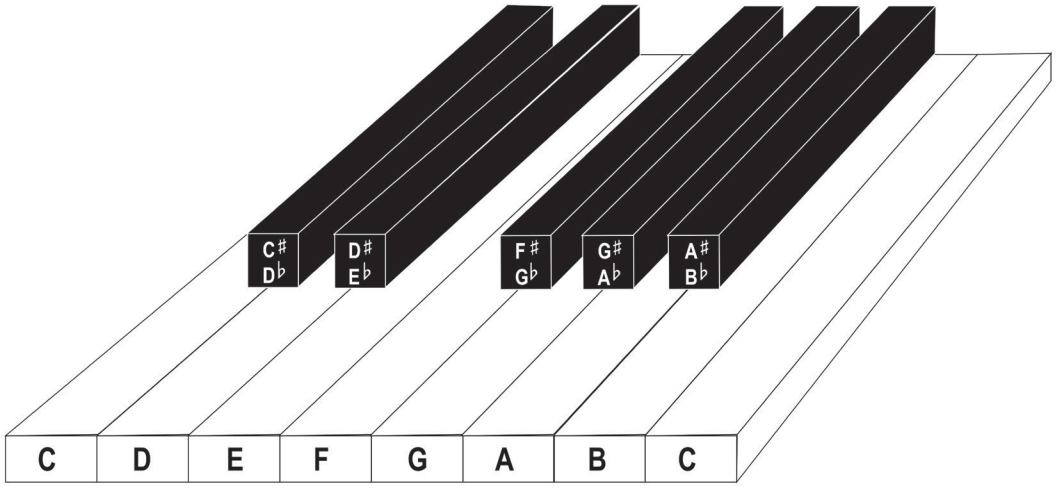

Figure 1.4 | The keyboard and the musical alphabet.
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When a sound wave is generated, it often generates other waves or ripple effects, depending on the medium through which it travels. When a string of a certain length is set into motion, for example, its waves may also set other strings of varying lengths into motion.

The vibration with the lowest frequency is called the **fundamental pitch.** The additional definite pitches that are produced are called **overtones**, because they are heard above or "over" the fundamental pitch (tone). Our musical alphabet consists of seven letters repeated over and over again in correspondence with these overtones. Please see Figure 1.6 for the partials for the fundamental pitch C:

To return to the musical alphabet: the first partial of the overtone series is the loudest and clearest overtone heard "over" the fundamental pitch. In fact, the sound wave of the first overtone partial is vibrating exactly twice as fast as its fundamental tone. Because of this, the two tones sound similar, even though the first overtone partial is clearly higher in pitch than the fundamental pitch. If you follow the overtone series, from one partial to the next, eventually you will see that all the other pitches on the keyboard might be generated from the fundamental pitch and then displaced by **octaves** to arrive at pitches that move by **step** (refer to Figure 1.6).

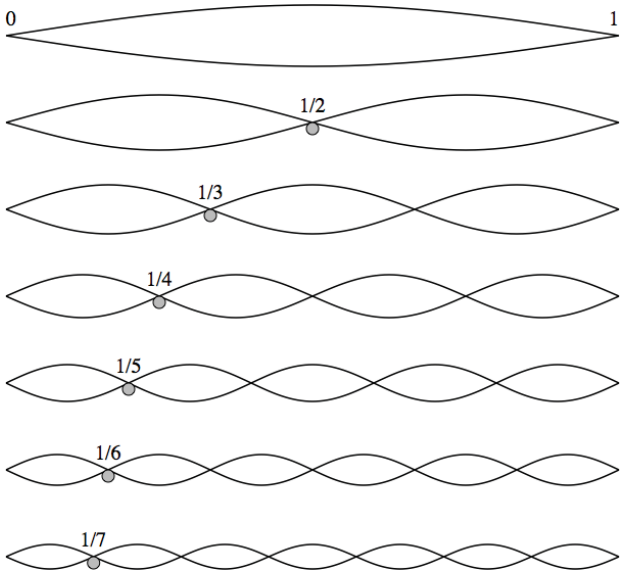

Figure 1.5 | Overtones of a vibrating string
Author | User "Qef"
Source | Wikimedia Commons
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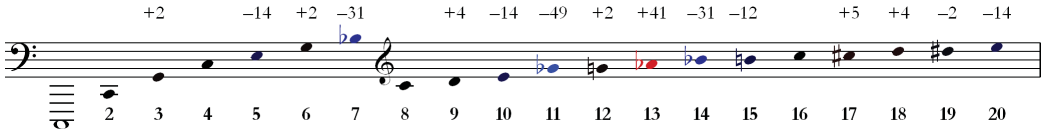

Figure 1.6 | Partials of C
Author | User "MusicMaker5376"
Source | Wikimedia Commons
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Watch these two videos for an excellent explanation of the harmonic series from none other than Leonard Bernstein himself, famous conductor of the New York Philharmonic and composer of the music of *West Side Story*.

~~**Ex. 1.2: The Harmonic Series**~~

~~https://www.youtube.com/watch?v=8n3qMB6AD_U~~
~~https://www.youtube.com/watch?v=iDTj6tBnHIA~~

The distance between any two of these notes is called an **interval**. On the piano, the distance between two of the longer, white key pitches is that of a step. The longer, white key pitches that are not adjacent are called leaps. The interval between C and D is that of a second, C and E that of a third, the interval between C and F that of a fourth, the interval between C and G that of a fifth, the interval of C to A is a sixth, the interval of C to B is a seventh, and the special relationship between C and C is called an octave.

Other Properties of Sound: Dynamics, Articulation, and Timbre

The volume of a sound is its **dynamic**; it corresponds with the **amplitude** of the sound wave. The articulation of a sound refers to how it begins and ends, for example, abruptly, smoothly, gradually, etc. The **timbre** of a sound is what we mean when we talk about tone color or tone quality. Because sound is somewhat abstract, we tend to describe it with adjectives typically used for tactile objects, such as "gravelly" or "smooth," or adjectives for visual descriptions, such as "bright" or "metallic." It is particularly affected by the ambience of the performing space, that is, by how much echo occurs and where the sound comes from. Timbre is also shaped by the **equalization (EQ)**, or balance, of the fundamental pitch and its overtones.

The video below is a great example of two singers whose voices have vastly different timbres. How would you describe Louis Armstrong's voice? Perhaps you would call it "rough or "gravelly." How would you describe Ella Fitzgerald's voice? Perhaps it could be called "smooth" or "silky."

Ex. 1.3: Louis Armstrong and Ella Fitzgerald

https://www.youtube.com/watch?v=J2oEmPP5dTM

MUSIC NOTATION

The development of music notation was absolutely critical to the rise of music that used more than just one melody. Everything that has developed in Western music after 1040 CE—from music of many independent voices (polyphonic), to solo voices with keyboard or group accompaniments, to the popular music we enjoy today—grew from this development. Though modern scholars have found examples of written musical symbols as far back as 900 CE, the staff notation system developed by **Guido of Arezzo** and others who followed him allowed for the accurate preservation and distribution of music. Music notation also greatly contributed to the growth, development, and evolution of the many musical styles over the past one thousand years.

Because of his contributions to the development of music notation, Guido of Arezzo is arguably the most important figure in the development of written music in the Western world. He developed a system of lines and spaces that enabled mu-

sicians to notate the specific notes in a melody. The development of music notation made it possible for composers to notate their music accurately, allowing others to perform the music exactly the way each composer intended. This ability allowed polyphonic (many voiced) music to evolve rapidly after 1040 CE. The video linked below is an excellent resource that explains Guido's contributions in more detail.

Ex. 1.4: Guido of Arezzo

http://www.youtube.com/watch?v=LxkstaYPztM

The popularity of staff notation after Guido paved the way for the development of a method to notate rhythm. The system of rhythmic notation we use today in Western music has evolved over many years and is explained in the following link.

Ex. 1.5: Rhythmic Notation by Andrew Poushka (2003)

http://www.studybass.com/lessons/reading-music/rhythmic-notation

The following prepared college marching band arrangement is adapted from DJ Khaled's popular tune "All I Do is Win," which shows an example of how staff notation is used today.

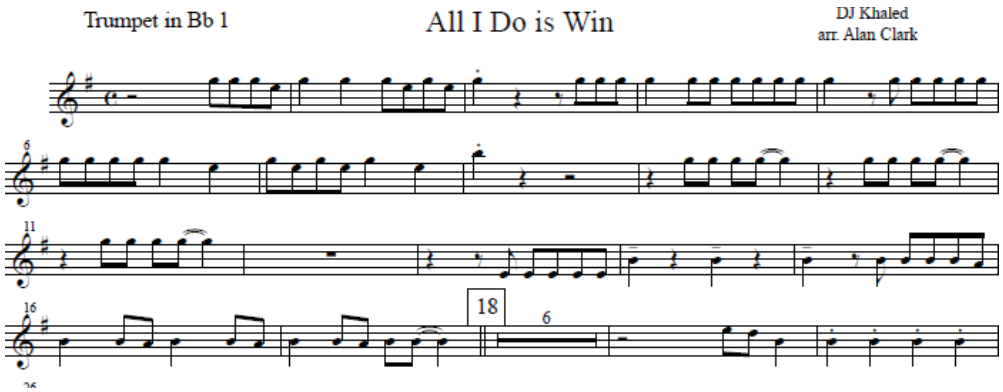

Figure 1.7 | "All I Do Is Win"
Author | N. Alan Clark
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MELODY

The melody of a song is often its most distinctive characteristic. The ancient Greeks believed that melody spoke directly to the emotions. **Melody** is the part of the song that we hum or whistle, the tune that might get stuck in our heads. A more scientific definition of melody might go as follows: melody is the coherent succession of definite pitches in time. Any given melody has range, register, motion, shape, and phrases. Often, the melody also has rhythmic organization.

The first of these characteristics, range, is one that we've already encountered as we talked about pitch. The range of a melody is the distance between its lowest and highest notes. We talk about melodies having narrow or wide ranges. Register is also a concept we discussed in relation to pitch. Melodies can be played at a variety of registers: low, medium, high.

As melodies progress, they move through their given succession of pitches. Each pitch is a certain distance from the previous one and the next. Melodies that are meant to be sung tend to move by small intervals, especially by intervals of seconds or steps. A tune that moves predominantly by step is a stepwise melody. Other melodies have many larger intervals that we might describe as "skips" or "leaps." When these leaps are particularly wide and with rapid changes in direction (that is, the melody ascends and then descends and then ascends and so forth), we say that the melody is **disjunct**. Conversely, a melody that moves mostly by step, in a smoother manner—perhaps gradually ascending and then gradually descending—might be called **conjunct**.

Shape is a visual metaphor that we apply to melodies. Think of a tune that you know and like: it might be a pop tune, it might be from a musical, or it might be a song you recall from childhood. Does it correspond with any of the shapes in Figure 1.12?

In other words, do the pitches of the melody primarily ascend; shape A? Descend; shape B? Oscillate, much like a wave; shape C? Ascend, arch up, and then descend; shape D? These are shapes that we might hear unfolding over time. As we think back to a melody that we know, we can replay it in our mind and visualize the path that it traces. Sing the childhood tune "Row, Row, Row Your Boat" to yourself. Which shape from Figure 1.12 do youthink it is most like? "D" is the best answer. Now lookat the musical notation for "Row, Row, Row Your Boat."

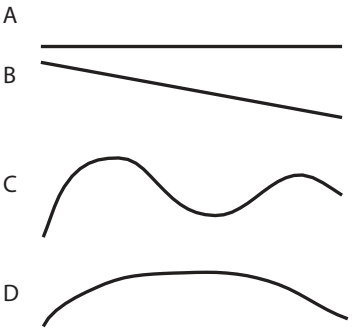

Figure 1.12 | Melodic Shapes
Author | Corey Parson
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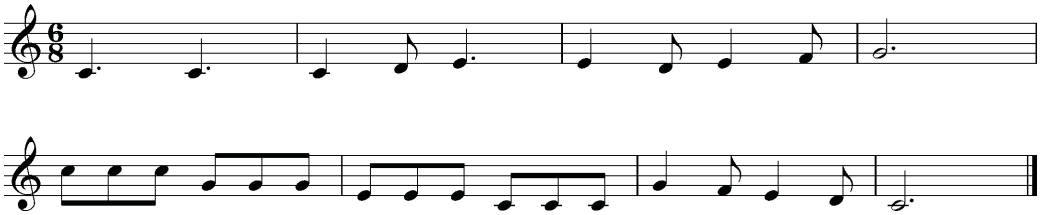

Figure 1.13 | "Row, Row, Row Your Boat"
Author | Arranged by N. Alan Clark
Source | Traditional Melody
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Even if you can't read music, hopefully you can see how the note heads trace an arch-like shape, similar to the shape labeled "D" in Figure 1.12. Most melodies have smaller sub-sections called **phrases**. These phrases function somewhat like phrases in a sentence. They are complete thoughts, although generally lacking a sense of conclusion. In the song "Row, Row, Row Your Boat," the music corresponding with the words "Row, row, row your boat," might be heard as the first phrase and "gently down the stream," as the second phrase. "Merrily, merrily, merrily, merrily," comprises a third phrase, and "life is but a dream," a fourth, and final, phrase.

Melodies are also composed of **motives**. A motive is the smallest musical unit, generally a single rhythm of two or three pitches. In "Row, Row, Row Your Boat," the music set to "merrily" might be heard as a motive. Motives repeat, often in se quence. A **sequence** is a repetition of a motive or phrase at a different pitch level. Thus, in "Row, Row, Row Your Boat," the first time you hear "merrily" is when it is at the top of the melody's range. The next time, it is a bit lower in pitch, the next time a bit lower still, and the final time you hear the word, it is sung to the lowest pitch of the melody. Another song that you might know that has sequences is "My Country, 'Tis of Thee."

Ex. 1.12: Mormon Tabernacle Choir "My Country, 'Tis of Thee" (2014)

https://www.youtube.com/watch?v=eWJI00A7fLM

HARMONY

Most simply put, **harmony** is the way a melody is accompanied. It refers to the vertical aspect of music and is concerned with the different music sounds that occur in the same moment. Western music culture has developed a complex system to govern the simultaneous sounding of pitches. Some of its most complex harmonies appear in jazz, while other forms of popular music tend to have fewer and simpler harmonies.

We call the simultaneous sounding of three or more pitches a **chord**. Like intervals, chords can be consonant or dissonant. **Consonant** intervals and chords tend to sound sweet and pleasing to our ears. They also convey a sense of stability in the music. **Dissonant** intervals and chords tend to sound harsher to our ears, and often convey a sense of tension or instability. In general, dissonant intervals and chords tend to resolve to consonant intervals and chords. Seconds, sevenths, and tri-tones sound dissonant and resolve to consonance. Some of the most consonant intervals are unisons, octaves, thirds, sixths, fourths, and fifths. From the perspective of physics, consonant intervals and chords are simpler than dissonant intervals and chords. However, the fact that most individuals in the Western world hear consonance as sweet and dissonance as harsh probably has as much to do with our musical socialization as with the physical properties of sound.

A listening example of consonance may be found at the following links:
http://real.darton.edu/faculty/kluball/MUSC1100/Question 11.mp3
http://real.darton.edu/faculty/kluball/MUSC1100/Question 23.mp3

An example of dissonance may be found at the following links:
http://real.darton.edu/faculty/kluball/MUSC1100/Question 9.mp3
http://real.darton.edu/faculty/kluball/MUSC1100/Question 18.mp3

The **triad** is a chord that has three pitches. On top of its root pitch is stacked another pitch at the interval of a third higher than the root. On top of that second pitch, another pitch is added, another third above. If you add a fourth pitch that is a third above the previous pitch, you arrive at a **seventh chord**. (You may be wondering why we call chords with three notes "triads" and notes with four chords "seventh chords." Why not "fourth chords?" The reason has to do with the fact that the extra note is the "seventh" note in the scale from which the chord is derived. (We will get to scales shortly.) Seventh chords are dissonant chords. They are so common in jazz, however, that they do not always sound like they need to resolve to consonant chords, as one might expect. One also finds chords with other additional tones in jazz: for example, ninth chords, eleventh chords, and thirteenth chords. These chords are related by stacking additional thirds on top of the chord.

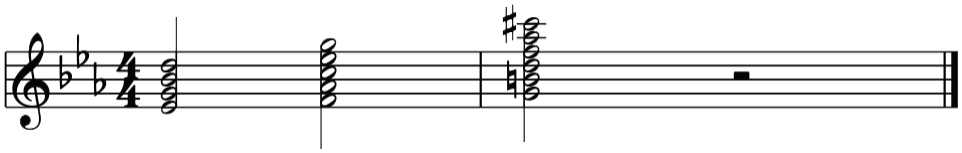

Figure 1.14 | Seventh, ninth, and eleventh chords in musical notation
Author | Corey Parson
Source | Original Work
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Key (sometimes called "tonality") is closely related to both melody and harmony. The key of a song or composition refers to the pitches that it uses. A key is a collection of pitches, much like you might have with a collection of stamps, bottles, etc. The most important pitch of a key is its **tonic,** that is, the note from which the other pitches are derived. For example, a composition in C major has C as its tonic; a composition in A minor has A as its tonic; a blues in the key of G has G as its tonic. A key is governed by its **scale**. A scale is a series of pitches, ordered by the interval between its notes. There are a variety of types of scales. Every major scale, whether it is D major or C major or G-sharp major, has pitches related by the same intervals in the same order. Likewise, the pitches of every minor scale comprise the same intervals in the same order. The same could be said for a variety of other scales that are found in jazz, rock, and popular music, including the blues scale and the pentatonic scale.

C-major scale			C	D	E	F	G	A	B	C
A-minor scale	A	B	C	D	E	F	G	A		
Blues scale on A	A		C	D	E		G	A		
					(E-flat)					

Table 1.1: C major scale, A minor scale, Blues scale on A

Major and minor scales are most often found in Western music today. The difference of sound in the major scale as opposed to the minor scale is in the perception of the sound. Major sounds relatively bright and happy. "Happy Birthday" and "Joy to the World" (the Christmas Carol) are based on the major mode.

~~Examples of Major scales excerpts may be heard at the following links:~~
~~http://real.darton.edu/faculty/kluball/MUSC1100/Question 14.mp3~~
~~http://real.darton.edu/faculty/kluball/MUSC1100/Question 3.mp3~~

Minor sounds relatively more subdued, sad, or melancholy. The Christmas Carol "We Three Kings" is in the minor mode.

~~Examples of Minor mode excerpts may be heard at the following links:~~
~~http://real.darton.edu/faculty/kluball/MUSC1100/Question 24.mp3~~
~~http://real.darton.edu/faculty/kluball/MUSC1100/Question 16.mp3~~

You might note that the simplest form of the blues scale (Table 1.1) is a type of pentatonic or five-note scale. This reflects the origins of the blues in folk music; much of the folk music around the world uses pentatonic scales. You might also note that the blues scale on A, has a note suspended below it, an E-flat (a pitch that is a half-step higher than D and a half-step lower than E). Otherwise, it is devoid of its blue notes. Blue notes are pitches that are sometimes added to blues scales and blues pieces. The most important blues note in the key of A is E-flat. In a sense, blues notes are examples of accidentals. **Accidentals** are notes that are not normally found in a given key. For example, F-sharp and B-flat are accidentals in the key of C. Accidentals are sometimes called **chromatic** pitches: the word chromatic comes from the ancient Greek word meaning color, and accidentals and chromatic pitches add color and excitement to a composition.

Chords can be built on every pitch of a scale. See Table 1.2 for the triads of C major.

C	**D**	**E**	**F**	**G**	**A**	**B**
E	**F**	**g**	**A**	**B**	**c**	**D**
G	**A**	**b**	**C**	**D**	**e**	**F**
I	**ii**	**iii**	**IV**	**V**	**vi**	**vii°**

Table 1.2: Chords of C Major

One can build seventh chords on these same pitches, by simply adding pitches. In the key of C major, the C major triad is considered the tonic triad (I), because it is built on the tonic of the key. Every other chord in C major tends to resolve to the tonic chord. The two next important chords are the F chord, which we call the IV chord or subdominant, and the G chord, which we call the V chord or dominant. Popular music also uses the VI chord a lot. The chords of a key tend to progress in an orderly fashion. Certain chords tend to resolve to other chords. The dominant or V chord, normally resolves directly to the tonic or I chord. We call a series of chords a **chord progression**.

One of the most important chord progressions for jazz and rock is the blues progression.

In the blues, the tonic chord (I) moves to the subdominant chord (IV) and then back to the tonic chord (I) before moving to the dominant chord (V) and finally back to the tonic (I). This often happens in the space of twelve bars or measures and thus this progression is sometimes called the **twelve-bar blues**. In the key of D, it would look like the following:

Root of the chord	**D**	**G**	**D**	**A**	**G**
Chord Symbol	**I**	**(IV)**	**I**	**V**	**(IV)**
Number of bars	**4**	**2**	**2**	**2**	**2**

Table 1.3: Twelve-bar blues in the key of D

As you can see, sometimes the dominant chord (V) briefly shifts back to the subdominant chord (IV) before finally resolving to the tonic chord.

Chord progressions play a major role in structuring jazz, rock, and popular music, cueing the listener to beginnings, middles, and ends of phrases and the song as a whole. Chord progressions in particular, and harmony in general, may be the most challenging aspects of music for the beginner. Hearing chords and chord progressions requires that one recognize several music phenomena at the same time. Chords may change rapidly, and a listener has to be ready to move on to the next chord as the music progresses.

The best way to learn to hear harmonies is to start with simple examples and ask general questions. ~~Listen to "Light My Fire" (1967) by the Doors, using the link below. See if you can hear the general difference between the verses, which use mostly minor chords, and the chorus, which uses mostly major chords. If you continue to listen, you will eventually be able to hear both.~~

~~**Ex. 1.13. The Doors, "Light my Fire" (1967)**~~

~~https://www.youtube.com/watch?v=deB_u-to-IE~~

RHYTHM

When you think of the word rhythm, the first thing that might pop into your head is a drum beat. But rhythm goes much deeper than that. Earlier, we defined music as intentional organization of sounds. **Rhythm** is the way the music is organized in respect to time. It works in tandem with melody and harmony to create a feeling of order. The most fundamental aspect of rhythm is the **beat**, which is the basic unit of time in music. It is the *consistent* pulse of the music, just like your heartbeat creates a steady, underlying pulse within your body. The beat is what you tap your feet to when you listen to music. Imagine the beat as a series of equidistant dots passing through time as in the Figure 1.15.

Figure 1.15 | The Beat
Author | Thomas Heflin
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It should be noted that the beat does not measure exact time like the second hand on a clock. It is instead a fluid unit that changes depending on the music being played. The speed at which the beat is played is called the **tempo**. At quick tempos, the beats pass by quickly, as represented by Figure 1.16 below showing our beats pressed against each other in time.

Figure 1.16 | Fast Tempos
Author | Thomas Heflin
Source | Original Work
License | CC BY-SA 4.0

Figure 1.17 | Slow Tempos
Author | Thomas Heflin
Source | Original Work
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At slow tempos, the beats pass by slowly, as seen in Figure 1.17 showing our beats with plenty of space between them.

Composers often indicate tempo markings by writing musical terms such as "allegro" which indicates that the piece should be played at a quick, or brisk, tempo. In other cases, composers will write the tempo markings in beats per minute (BPM), when they want more precise tempos. Either way, the tempo is one of the major factors in establishing the character of a piece. Slow tempos are used in everything from sweeping love songs to the dirges associated with sadness or death. Take for example, Chopin's famous funeral march:

Ex. 1.14: Chopin "Piano Sonata Op.35 No.2"

https://www.youtube.com/watch?v=Hgw_RD_1_5I

Fast tempos can help to evoke anything from bouncy happiness to frenzied madness. One memorable example of a fast tempo occurs in "Flight of the Bumblebee," an orchestral interlude written by Nikolai Rimsky-Korsakov for his opera *The Tale of Tsar Saltan*, which evokes the busy buzzing of a bee.

Ex. 1.15: Nikolai Rimsky-Korsakov "Flight of the Bumblebee"

https://www.youtube.com/watch?v=aYAJopwEYv8

Beats are the underlying pulse behind music, while **meter** refers to the way in which those beats are grouped together in a piece. Each individual grouping is called a **measure** or a **bar** (referring to the bar lines that divide measures in written music notation). Most music is written in either duple meter (groupings of two), triple meter (groupings of three), or quadruple meter (groupings of four). These meters are conveyed by stressing or "accenting" the first beat of each grouping. In the figure below, you can see examples of triple and quadruple meter. The first beat of each bar is larger than the rest to indicate this accent. These larger beats are often referred to as strong beats, while the smaller beats between them. are referred to as weak beats.

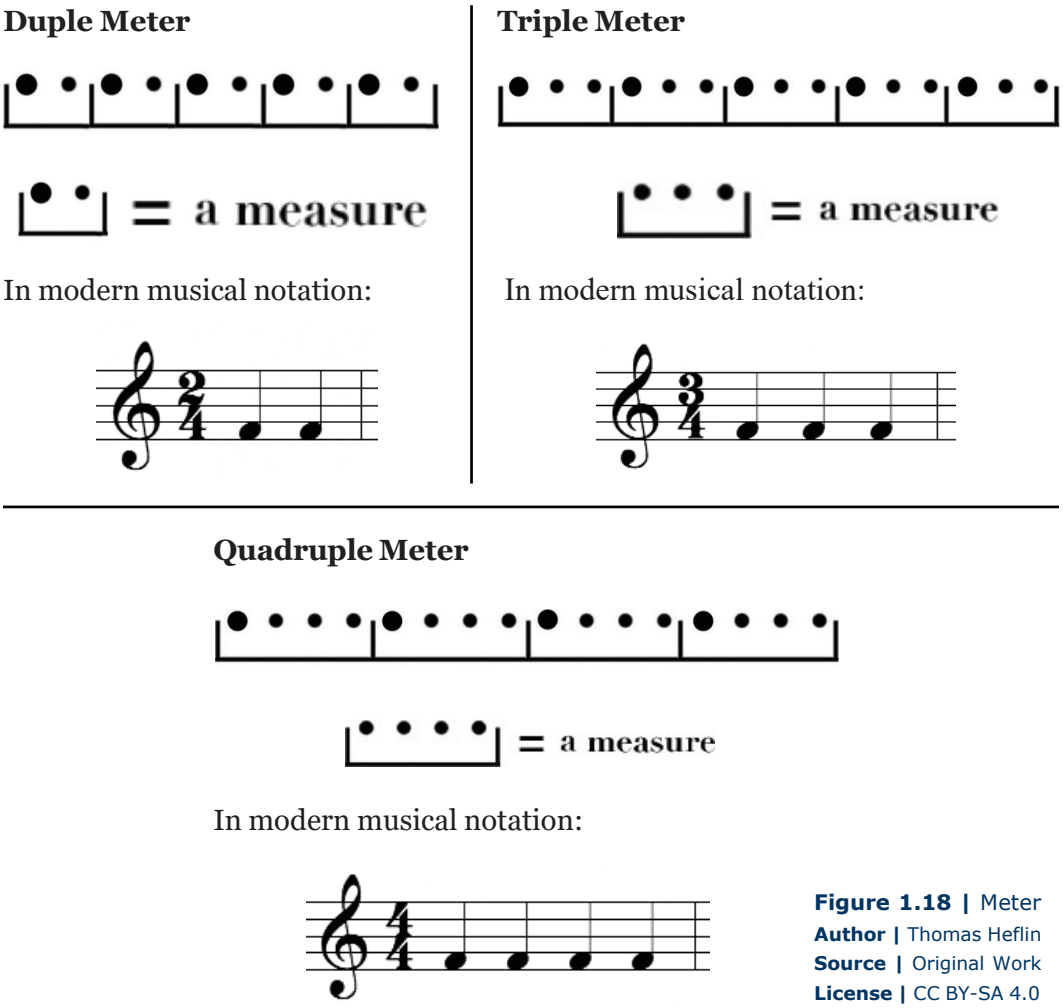

Figure 1.18 | Meter
Author | Thomas Heflin
Source | Original Work
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To illustrate how vital rhythm is to a piece of music, let's investigate the simple melody "Mary Had a Little Lamb." Below, the melody and chords are conveyed through standard musical notation. The meter is indicated by the two numbers four over four. (This is known to music readers as the **time signature**.) This particular time signature is also known as "common time" due to the fact that it is so widely used. The top number indicates the meter, or how many beats there are per

measure. The bottom number indicates which type of note in modern musical notation will represent that beat (in this case, it is the quarter note). The vertical lines are there to indicate each individual measure. As you can see, the melody on the top staff and the chords on the bottom staff line up correctly in time due to the fact that they are grouped into measures together. In this way, rhythm is the element that binds music together in time.

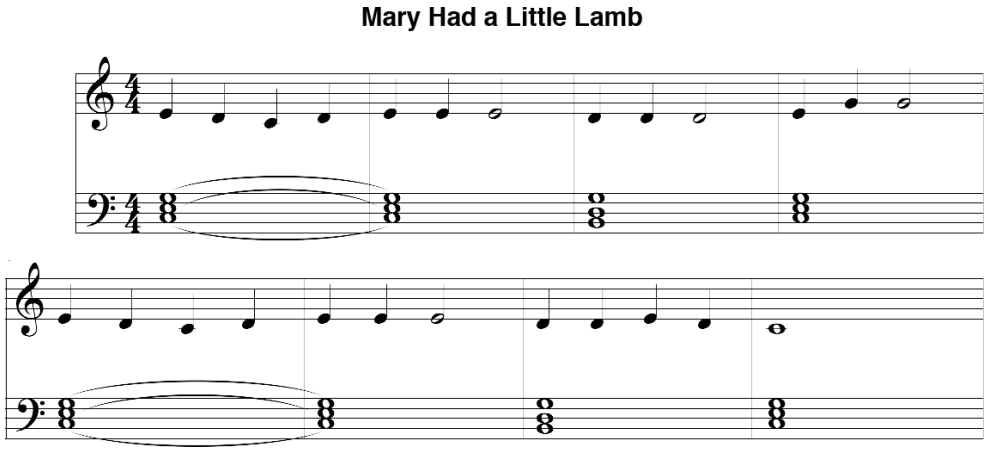

Figure 1.19 | "Mary Had a Little Lamb"
Author | Arranged by Thomas Heflin
Source | Traditional Melody
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One way to add a sense of rhythmic variation to music is through the use of syncopation. **Syncopation** refers to the act of shifting of the normal accent, usually by stressing the normally unaccented weak beats or placing the accent between the beats themselves as illustrated in Figure 1.20.

Figure 1.20 | Syncopation
Author | Thomas Heflin
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Syncopation is one of the defining features of ragtime and jazz, and is one aspect of rhythmic bounce associated with those genres of music. In Figure 1.21 below, it is the circled notes on the weak beats which are accented or emphasized.

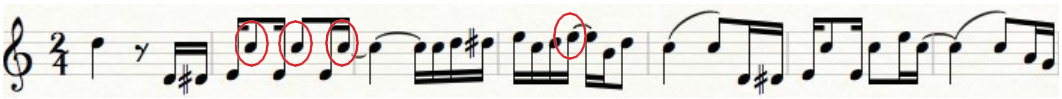

Figure 1.21 | "The Entertainer" by Scott Joplin
Author | Corey Parson
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In some cases, certain types of music may feature the use of a **polyrhythm**, which simply refers to two or more different rhythms being played at the same time. A common polyrhythm might pit a feeling of four against a feeling of three. Polyrhythms are often associated with the music of Africa. However, they can be found in American and European music of the twentieth century, such as jazz.

Listen to the example below of Duke Ellington playing his signature song, the Billy Strayhorn composition "Take the A Train." You will notice that the beats in the piece are grouped as four beats per measure. Pay special attention to what happens at 1:32 in the video. The horns begin to imply groupings of three beats (or triple meter) on top of the existing four beat groupings (or quadruple meter). These concurrent groupings create a sense of rhythmic tension that leads the band into the next section of the piece at 1:38 in the video.

Ex. 1.16: Duke Ellington "Take the A Train" https://www.youtube.com/watch?v=cb2w2m1JmCY

https://www.youtube.com/watch?v=hRGFqSkNjHk

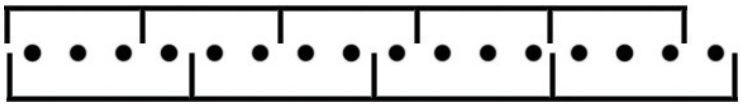

Figure 1.22 | Polyrhythm
Author | Thomas Heflin
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TEXTURE

Texture refers to the ways in which musical lines of a musical piece interact. We use a variety of general adjectives to describe musical texture, words such as transparent, dense, thin, thick, heavy, and light. We also use three specific musical terms to describe texture: monophony, homophony, and polyphony. Of these three terms, homophony and polyphony are most important for jazz, rock, and popular music.

Monophonic music is music that has one melodic line. This one melodic line may be sung by one person or 100 people. The important thing is that they are all singing the same melody, either in unison or in octaves. Monophony is rare in jazz, rock, and popular music. An example would be a folk melody that is sung by one person or a group of people without any accompaniment from instruments. Gregorian chant is another excellent example of monophonic music.

Ex. 1.17: Gregorian Chant

https://www.youtube.com/watch?v=_gElL8hdQD4

Homophonic music is music that has one melodic line that is accompanied by chords. A lot of rock and popular music has a homophonic texture. Anytime the tune is the most important aspect of a song, it is likely to be in homophonic texture. Elvis Presley's "Hound Dog" (1956), The Carter Family's version of "Can the Circle

be Unbroken" (1935), and Billy Joel's "Piano Man" (1973), are relatively good examples of homophony.

Polyphony simultaneously features two or more relatively independent and important melodic lines. Dixieland jazz and bebop are often polyphonic, as is the music of jam bands such as the Allman Bros. "Anthropology" (ca. 1946) for example, a jazz tune recorded by Dizzy Gillespie, Charlie Parker, and others reflects the busy polyphony typical in bebop. Some jazz played by larger ensembles, such as big bands, is also polyphonic at points, although in this case, there is generally a strong sense of a main melody. Much of the music that we will study in this text exists somewhere between homophony and polyphony. Some music will have a strong main melody, suggesting homophony, and yet have interesting countermelodies that one would expect in polyphony. Much rap is composed of many layers of sounds, but at times those layers are not very transparent, as one would expect in polyphony.

PUTTING IT ALL TOGETHER

Form in Music

When we talk about musical **form**, we are talking about the organization of musical elements—melody, harmony, rhythm, texture, timbre—in time. Because music is a temporal art, memory plays an important role in how we experience musical form. Memory allows us to hear repetition, contrast, and variation in music. And it is these elements that provide structure, coherence, and shape to musical compositions.

A composer or songwriter brings myriad experiences of music, accumulated over a lifetime, to the act of writing music. He or she has learned how to write music by listening to, playing, and studying music. He or she has picked up, consciously and/or unconsciously, a number of ways of structuring music. The composer may intentionally write music modeled after another group's music: this happens all of the time in the world of popular music where the aim is to produce music that will be disseminated to as many people as possible. In other situations, a composer might use musical forms of an admired predecessor as an act of homage or simply because that is "how it's always been done." We find this happening a great deal in the world of folk music, where a living tradition is of great importance. The music of the "classical" period (1775-1825) is rich with musical forms as heard in the works of masters such as Joseph Haydn and Wolfgang Amadeus Mozart. In fact, form plays a vital role in most Western art music (discussed later in the chapter) all the way into the twenty-first century. We will discuss these forms, such as the rondo and sonata-allegro, in later chapters, but for the purpose of this introduction, we will focus on those that might be more familiar to the modern listener.

The Twelve-Bar Blues

Many compositions that on the surface sound very different use similar musical forms. A large number of jazz compositions, for example, follow either the

twelve-bar blues or an AABA form. The twelve-bar blues features a chord progression of I-IV-I-V-IV-I. Generally the lyrics follow an AAB pattern, that is, a line of text (A) is stated once, repeated (A), and then followed by a response statement (B). The melodic idea used for the statement (B) is generally slightly different from that used for the opening a phrases (A). This entire verse is sung over the I-IV-I-V-IV-I progression. The next verse is sung over the same pattern, generally to the same melodic lines, although the singer may vary the notes in various places occasionally.

Listen to Elvis Presley's version of "Hound Dog" (1956) using the link below, and follow the chart below to hear the blues progression.

Ex. 1.18: Elvis Presley "Hound Dog" (1956)

https://www.youtube.com/watch?v=-eHJ12Vhpyc

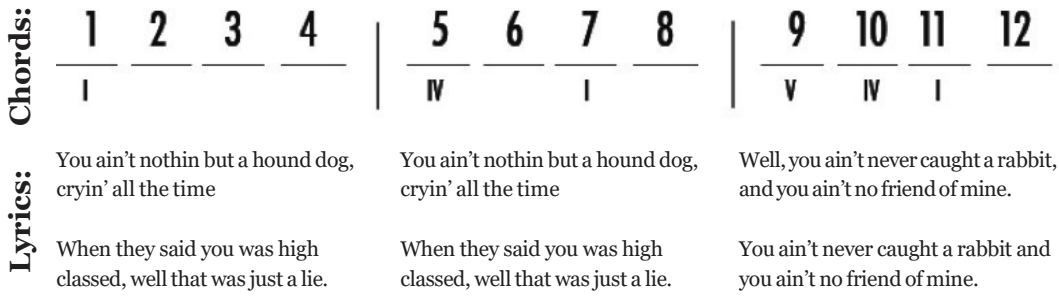

Figure 1.23 | Format Breakdown of Elvis's "Hound Dog"
Author | Thomas Heflin
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This blues format is one example of what we might call musical form. It should be mentioned that the term "blues" is used somewhat loosely and is sometimes used to describe a tune with a "bluesy" sound, even though it may not follow the twelve-bar blues form. The blues is vitally important to American music because it influenced not only later jazz but also rhythm and blues and rock and roll.

AABA Form

Another important form to jazz and popular music is AABA form. Sometimes this is also called thirty-two-bar form; in this case, the form has thirty-two measures or bars, much like a twelve-bar blues has twelve measures or bars. This form was used widely in songs written for Tin Pan Alley, Vaudeville, and musicals from the 1910s through the 1950s. Many so-called jazz standards spring from that repertoire. Interestingly, these popular songs generally had an opening verse and then a chorus. The chorus was a section of thirty-two-bar form, and often the part that audiences remembered. Thus, the chorus was what jazz artists took as the basis of their improvisations. "(Somewhere) Over the Rainbow," as sung by Judy Garland in 1939 (accompanied by Victor Young and his Orchestra), is a well-known tune that is in thirty-two-bar form.

1.5 GLOSSARY

Accidentals – notes that are not normally found in a given key

Acoustics – the study of how sound behaves in physical spaces

Acoustical Engineer – a person who works in the area of acoustic technology

Acoustician – a person who studies the theory and science of acoustics

Amplitude – refers to how high the wave form appears to vibrate above zero when seen on an oscilloscope; louder sounds create higher oscilloscope amplitude readings

Bar – see *measure*

Beat – the basic unit of time in music

Brass – instruments traditionally made of brass or another metal (and thus often producing a "bright" or "brassy" tone) whose sound is generated by blowing into a mouthpiece that is attached to a coiled tube

Chord – the simultaneous sounding of three or more pitches; like intervals, chords can be consonant or dissonant

Chord Progression – a series of chords

Chromatic – musical pitches which move up or down by successive half-steps

Composition – the process whereby a musician notates musical ideas using a system of symbols or using some other form of recording

Conjunct – a melody that moves mostly by step, in a smooth manner

Consonant – (adjective) term used to describe intervals and chords that tend to sound sweet and pleasing to our ears; consonance (noun), as opposed to dissonance, is stable and needs no resolution.

Cycles per Second (cps) – a definition of frequency of vibration; replaced by Hertz in 1960

Disjunct – a melody with wide leaps and rapid changes in direction

Dissonant – (adjective) intervals and chords that tend to sound harsh to our ears; dissonance (noun) is often used to create tension and instability, and the interplay between dissonance and consonance provides a sense of harmonic and melodic motion in music

Dynamic – the variation in the volume of musical sound (the amplitude of the sound waves)

Equalization (EQ) – the process of raising or lowering different frequencies of sound, either in a recording, or within a tone (overtones)

Form – the structure of the phrases and sections within a musical composition (Does it repeat?)

Frequency – how quickly or slowly a medium (solid, liquid, gas) vibrates and produces a sound

Fundamental Pitch – the lowest pitch in the harmonic series

Guido of Arezzo – a medieval music theorist who developed a system of lines and spaces that enabled musicians to notate the specific notes in a melody

Improvisation – the process whereby musicians create music spontaneously using the elements of music as building blocks

Instrumentation – the instruments comprising a musical group (including the human voice)

Interval – the distance in pitch between any two notes

Harmony – any simultaneous combination of tones and the rules governing those combinations (the way a melody is accompanied is also another way to define harmony)

Hertz (Hz) – the unit of frequency defined as one cycle per second and named after Heinrich Hertz (1957-1894) in 1960

Homophonic – musical texture comprised of one melodic line accompanied by chords

Key – the set of pitches on which a composition is based

Keyboard – instruments that are characterized by keyboards, such as the piano, organ, vibraphone, and accordion

Measure – a unit of time that contains a specific number of beats defined by the meter/ time signature

Melody – a succession of single tones in musical compositions

Meter – the way in which the beats are grouped together in a piece

Monophonic – musical texture comprised of one melodic line; a melodic line may be sung by one person or 100 people

Motive – the smallest musical unit of a melody, generally a single rhythm of two or three pitches

Music – sound and silence organized in time

Noise – a disorganized sound with no observable pitch

Octave – the distance between two musical pitches where the higher pitch vibrates exactly twice as many times per second as the lower

Oscilloscope - an electronic device that displays a visual representation of the different types of sound waves

Overtones (also known as harmonics) – a musical tone heard above a fundamental pitch

Partials – the sounds of different frequency that naturally occur above a fundamental (primary) tone

Percussion – instruments that are typically hit or struck by the hand, with sticks, or with hammers or that are shaken or rubbed by hand

Performing Forces – see instrumentation

Phrase – smaller sub-sections of a melody

Pitch – a tone that is composed of an organized sound wave

Polyphony – musical texture that simultaneously features two or more relatively independent and important melodic lines

Polyrhythm – two or more different rhythms played at the same time

Range – the number of pitches, expressed as an intervallic distance

Register – the low, medium, and high sections of an instrument or vocal range

Rhythm – the way the music is organized in respect to time

Scale – a series of pitches, ordered by the interval between its notes

Sequence – a repetition of a motive or phrase at a different pitch level

Seventh Chord – a chord that has four pitches stacked in intervals of thirds

Sine Wave – the simplest sound wave that occurs in nature. A pure sine wave contains no partials and is perfectly smooth and rounded in appearance on an oscilloscope.

Sound – the mechanical movement of an audible pressure wave through a solid, liquid, or gas

Sound Waves – longitudinal waves (compression and rarefaction waves) that travel through a solid, liquid, or gas

Step – the distance between adjacent notes in a musical scale

Strings – instruments whose sound is produced by setting strings in motion

Syncopation – the act of shifting the normal accent, usually by stressing the normally unaccented weak beats or placing the accent between the beats themselves

Synthesizers – electronic instruments (often in keyboard form) that create sounds using basic wave forms in different combinations

Tempo –the speed at which the beat is played

Texture – the ways in which musical lines of a musical piece interact

Timbre – the tone color or tone quality of a sound

Time signature – the numeric notation at the beginning of a line of music where the top number indicates how many beats are in each measure and the bottom number indicates which type of note will represent that beat

Tonic – the most important pitch of a key; the note from which the other pitches are derived

Triad – a chord that has three pitches stacked in intervals of thirds

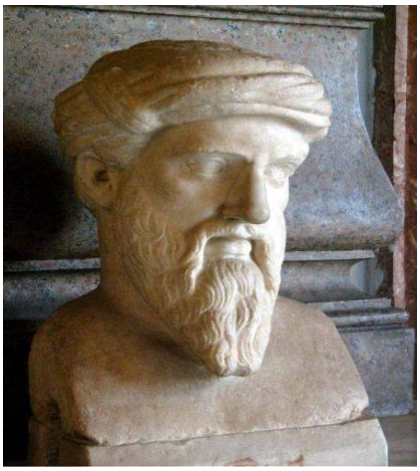
Twelve-Bar Blues – a twelve-bar musical form commonly found in American music

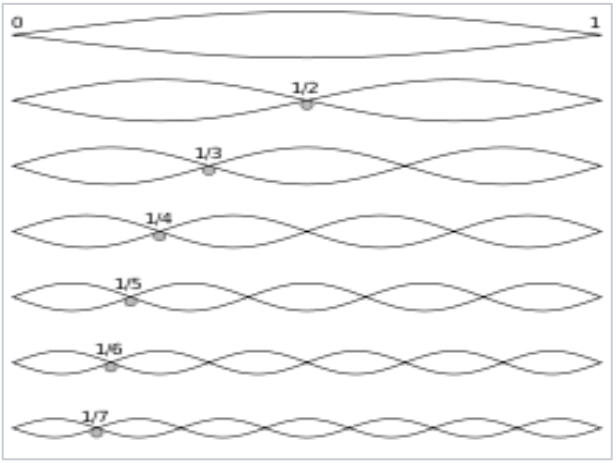
Vocal – having to do with the human voice

Woodwinds – instruments traditionally made of wood whose sound is generated by forcing air through a tube, thus creating a vibrating air column

Pythagoras & Acoustics

The word “acoustic” is derived from the Greek word ἀκουστικός (*akoustikos*), meaning “of or for hearing, ready to hear” and that from ἀκουστός (*akoustos*), “heard, audible,” which in turn derives from the verb ἀκούω(*akouo*), “I hear.”





In the 6th century BC, the ancient Greek philosopher Pythagoras wanted to know why some combinations of musical sounds seemed more beautiful than others, and he found answers in terms of numerical ratios representing the harmonic overtone series on a string. He observed that when the lengths of vibrating strings are expressible as ratios of integers (e.g. 2 to 3, 3 to 4), the tones produced will be harmonious, and the smaller the integers the more harmonious the sounds. For example, a string of a certain length would sound particularly harmonious with a string of twice the length (other factors being equal).

According to legend, Pythagoras discovered the foundations of musical tuning by listening to the sounds of four blacksmiths’ hammers, which produced consonance and dissonance when they were struck simultaneously.

Whatever the details of the discovery of the relationship between music and ratio, it is regarded as historically the first empirically secure mathematical description of a physical fact. As such, it is symbolic of, and perhaps leads to, the Pythagorean conception of

mathematics as nature's *modus operandi*. As Aristotle was later to write, "the Pythagoreans construct the whole universe out of numbers."

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