

Chapter

7

KEY WORDS

aerophone
chordophone
electrophone
gamelan
idiophone
material culture
membranophone
organology
overtone series
vibrato

Learning Objectives

After successfully completing this unit, the student will understand that:

1. Every sound has a distinctive timbre because of the acoustical phenomenon of the overtone series.
2. Different cultures have distinct aesthetic preferences for particular sound qualities.
3. Instruments are themselves an important aspect of musical culture—what ethnomusicologists term “material culture.”
4. There are a wealth of instrument classification systems that exist worldwide. Some of these schemes are subject to extensive written theory while others exist as part of an oral tradition.

5. The Sachs-Hornbostel system of instrument classification has been more widely used than any other during the twentieth century. The categories are divided according to the physical characteristics of sound production into chordophones, aerophones, idiophones, membranophones, and electrophones.

Television Program

Timbre: The Color of Music

Audio Selections

14. Beethoven's *Symphony* No. 5 in C minor, First Movement
31. North Indian tanpura played by Ira Landgarten
21. Buddhadev Das Gupta, Performance in “Rag Kamod”
20. Tabla solo performed by Ray Spiegel
16. “Hifumi Hachi Gaeshi”
32. Tadao Sawai, “Tori No Yo Ni”
26. “Dikrayati.” Simon Shaheen, violin; Najib Shaheen, 'ud; Bassam Saba, nay; Michel Merhej, daff.
62. 'Ud taqasim in Maqam Nahawand.
33. Modulatory taqasim.
 3. Tuvan Throat Singing in Cave
 1. Bosnian ganga “Sjajna Zvezdo”
29. “Rocks of Bawn” sung by Joe Heaney (1st verse)
7. “Flower of Magheralee” sung by Pat Kilbride
6. “Pretty Polly” sung by John Cohen

Timbre: The Color of Music

“The most important feature about music is timbre as it is the principal feature that separates the voices of the different instruments. . . . Timbre also allows us to recognize the voice of a friend from that of some one unknown.”

“THIS IS YOUR BRAIN ON MUSIC”.
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This chapter provides an introduction to the concept of timbre or tone color in music. Across the globe, a rich variety of instrumental and vocal traditions create an astonishing assortment of tone colors. The tonal quality of any given instrument or voice is influenced by a number of factors, including method of sound production, instrument construction, playing technique, and aesthetics. The chapter explores methods of sound production and then focuses on musical instruments in several cultures. The chapter concludes with a comparison of vocal timbre in Tuva, Bosnia, Ireland, and in the Western classical tradition.

Timbre, like pitch and rhythm, is one of the fundamental elements of music. Pitch refers to a note's frequency, its highness or lowness, rhythm to its duration, and timbre to its tonal quality or color. In describing a sound's timbre, we often resort to words normally used to identify non-musical qualities such as appearance or temperature; a voice or instrument can sound dark or light, warm or cool, mellow or metallic, smooth or rough, covered or open, deep or thin. Distinctions of timbre refer not to the fundamental pitch of a note, but rather to the coloration that distinguishes the various sounds of a single pitch played on different instruments. The note "A" sounds differently on a flute than on an oboe or violin; the pitch on all three instruments may be identical, but we hear differences in timbre.

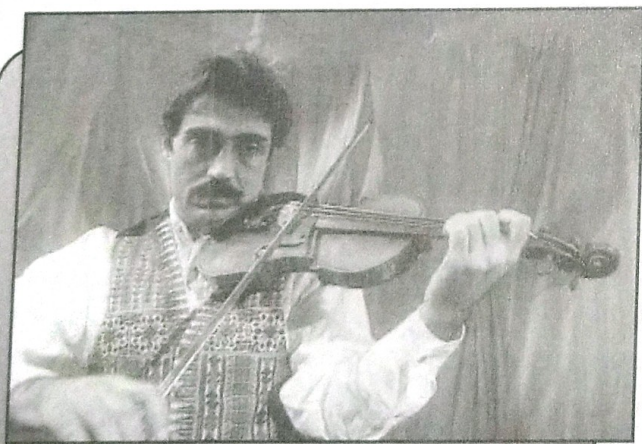
Every sound has a distinctive timbre because of the acoustical phenomenon of the overtone series. As discussed in Chapter 1, each individual tone consists of a fundamental pitch and a simultaneously sounding series of progressively higher overtones, also called partials or harmonics. The fundamental pitch is the actual note sung or played and it is usually the tone we can identify and hear most clearly. The particular overtones of the series that resonate along with the fundamental pitch determine the timbre of the sound. Each instrument has its own timbre based on the particular overtone structure that it generates.

The shape of an instrument and the material from which it is made emphasize particular partials. Metal flutes sound clear and bright because

their shape and material emphasize only the second harmonic, one octave above the fundamental. Wooden flutes often sound richer and warmer, because the resonant properties of wood emphasize a wider range of partials. Clarinets have a very different sonority because their cylindrical tube construction largely eliminates the even numbered harmonics. Similarly, the open "G" string of a violin sounds brighter and thinner than the same pitch sounded on the open "G" string of the larger viola. The size of the latter instrument alters the weight given to particular partials, darkening the sound.

Timbre is not static; a single note's overtones fluctuate in intensity as the tone starts up, is sustained, and decays. Even though we usually hear one pitch as a single entity, the shape that each note takes as it is played can be divided into three parts: a beginning or attack, a middle or constant state, and an end or decay.¹ Many plucked instruments, such as gui-

▼ Simon Shaheen



tars, mandolins, and banjos, have a sharp attack with almost immediate decay, while wind and bowed instruments tend to have a softer attack, a sustained period, and a decay controlled by the performer. The clashing of cymbals, with their resultant sustained ringing, has a very different sound shape than the striking of a woodblock, with its nearly instant decay.

Different cultures have distinct aesthetic preferences for particular sound qualities: the tone colors produced by the highly trained singers in the Peking Opera differ considerably from the timbre of either Western opera singers or ganga singers from Bosnia. The Balinese preference for the tone colors produced by bronze or iron percussion instruments played together in the gamelan is quite different from timbres found in the Trinidadian steel band. In Zimbabwe, the buzzing tones of the mbira are considered essential to its overall sound.

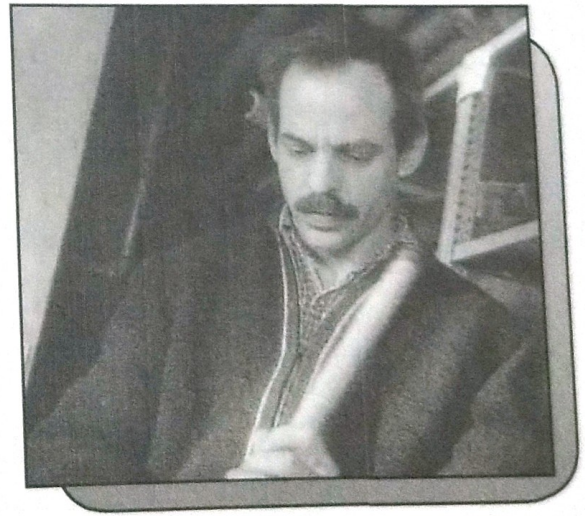
Even the same instrument can produce contrasting timbres depending on the player or on its cultural context. One saxophone player may produce strikingly different tone colors than another using the same instrument; an Irish fiddler's playing may sound considerably unlike the playing of either a Western classical, Arabic, or North Indian violinist.

According to ethnomusicologist and instrument maker Fred Stubbs, timbre is related to tradition, technique, and structure, as well as to individual expertise and sensitivity:

▼ Fred Stubbs

... the real place that timbre lives [is] inside the instrumentalist's heart and head. If the instrumentalist doesn't hear the timbre in the instrument and the music, then the audience won't hear it either. I guess I'm trying to say that music is composed of more than formulae, but also of this ineffable kind of expression that might be at the heart of many musics.²

Timbre is perhaps the most personal element in music, the quality that allows us to distinguish between the voices of individual singers or the unique tonal "signatures" of particular instrumentalists. Jazz musician Josh Redman talks about the timbral qualities that caused him to choose the saxophone as his artistic voice:



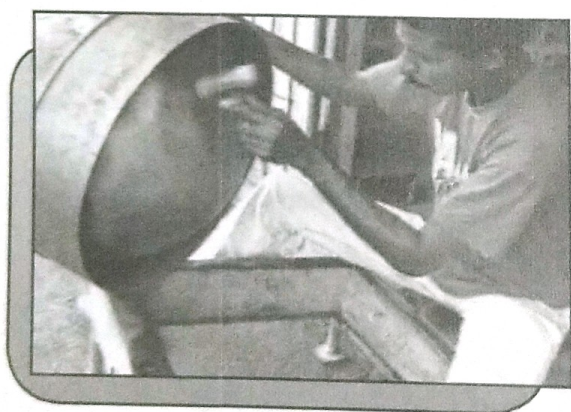
I recognized early on that the saxophone would be the way I could sing, that would be my voice. . . . I felt a connection with the instrument, and it's hard to describe it beyond that because I think the connection that you feel with music, and with an instrument, is oftentimes beyond literal or verbal description. . . . I think one thing that really attracted me to the sound of the tenor saxophone was

its incredible emotional range. It's an instrument that can be very very gentle and poignant and sensitive and vulnerable, yet at the same time, very, very powerful and passionate, and at times almost violent, very robust, very raw. And I like having those expressive options, and I like having them integrated into the sound of one instrument.³

Timbre can also be viewed as the particular palette of tone colors produced by one instrument or voice or the tone colors that result from a group. The timbres of a symphony orchestra are very different from those of a wind quintet or a solo violin. Some cultures seem to prefer listening to one player or singer at a time, some favor ensembles where each instrument or voice has a similar timbre, while others create ensembles with instruments of different sonorities. Many cultures employ different sizes and kinds of groupings of musicians depending on the function, style, and context of musical performance. In each case, timbre is an essential component of the culture's overall musical aesthetic.

Instruments are themselves an important aspect of musical culture—part of what ethnomusicologists term “material culture.” Aside from the human body which can be used as an instrument for singing, clapping, snapping the fingers, whistling, or percussive dancing, the objects used as instruments in a culture are often based on local natural resources, such as wood, clay, bamboo, reeds, gourds, silk, and skins. The large calabash gourds that make up the body of the North Indian sitar are plentiful throughout India; the rattles common in many Native American traditions are made from the small gourds that grow in North America. Many drums throughout Africa are made from hollowed-out trees; flutes from every corner of the globe are made from bamboo or wood. The availability and use of specific natural substances help to determine what instruments will be made, and therefore, what timbres will be indigenous to a particular culture.

The work of the instrument maker is to transform these raw materials into a music-making tool, which is why instrument construction is closely allied to technology. The advent of bronze production in Southeast Asia, for example, greatly impacted the creation of large orchestras of gong-chime instruments made out of bronze. In Trinidad, instrument makers in the 1940s transformed cast off man-made materials in the form of oil drums into sophisticated instruments.



▲ Making a steel drum in Trinidad

All makers require technical skills in order to correctly construct and tune their instruments, but many are also artists. Instruments are often highly decorated with precious materials and considered works of art in themselves.

Instruments are also often believed to be sacred objects. Among the Akan in Ghana, drums are believed to be sentient beings imbued with the spirit of the tree from which they were made. Instrument makers must ask for a blessing from the tree before cutting it down to make the drum. In Java, the great gong is the most highly revered instrument and gong makers and their craft are associated with magical powers. The other instruments of the gamelan are also considered sentient beings. The Australian ethnomusicologist Margaret Kartomi compares two special objects of Javanese culture—percussion instruments and rice:

Indeed, percussion is to the instrumental culture what the staple crop rice is to the food culture. . . . Taboos are operative against walking over instruments or sitting on bags of rice, because spirits are believed to reside in them. Indeed these spirits, when properly appeased, are thought to beautify the sounds of the instruments or to affect the quality of the rice they inhabit.⁴

The qualities ascribed to instruments—whether they are thought of as tools, works of art, sacred objects, or all three—determine their place in a given society. Because of their importance, musical instruments have been classified in most cultures. While sound production is the basis for instrument construction, people have classified instruments in ways that embrace many other aspects of culture. In the following pages we will use the mechanics of sound production as a springboard to understand how several cultures have classified their instruments.



◀ Central Javanese Gamelan

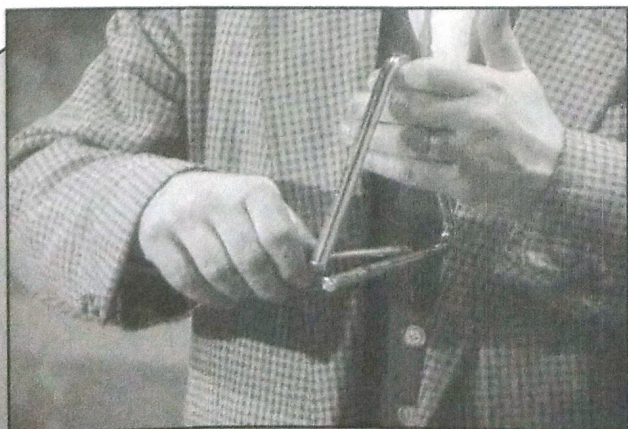
SOUND PRODUCTION AND INSTRUMENT CLASSIFICATION SYSTEMS

Every musical sound has four parameters, of which timbre is one. The sound also has pitch—its highness or lowness; it has amplitude—its relative loudness or softness; and it has duration—how long it lasts in time. When we think particularly of timbre, we think of the instrument or voice that produces the sound. It is perhaps the easiest of the four parameters to recognize and identify because it is linked to something tangible: a sound producing agent.

In order to make a sound you need three things: a physical object which is vibrating, a medium to carry the vibrations or sound waves, and an ear to hear the sound and turn it into something meaningful. In order to create music, the physical object must be an instrument or voice capable of vibrating and resonating. The sounds of a violin, for example, are produced by strings set in motion by the player's bow, the instrument's resonating body, sound holes, and a bridge:

When you listen to a violin, you're hearing chemical energy in the violinist's muscles transformed into sound. The energy enters the violin by scraping a bow against strings. Not much sound comes to your ear directly from the strings, where the surface area is too small to push at very much air. But the strings are strung across a bridge . . . and this transmits the string vibrations to the body of the violin, where a much greater surface area presses against more air to make more sound. The violin body transmits best the frequencies it resonates at, while damping all others. Some of a violin's characteristic sound, its timbre, is attributable to its strings, and some to the resonance of its body.⁵

▼ The Triangle, an Idiophone



A vibrating sound source can be produced in a finite number of ways: besides responding to the friction of a bow, stretched strings may be plucked or struck; air may be forced through a tube at a higher pressure than the air outside, causing the tube to vibrate; a stretched skin may be hit, rubbed, or scraped; a solid object may be shaken, hit, scraped, rubbed, or whirled; and finally, the sound may be produced electronically. The human voice consists of a sound producing agent in the form of reed-like vocal chords, an air supply from the lungs, and resonating cavities—the mouth, nose, throat, and chest.

These four categories of sound production—string, wind, percussion, and electronic—are the basis of musical instrument construction and classification all over the world.

In the early twentieth century, a number of European acousticians and musicologists used these categories of sound production to classify musical instruments from different parts of the globe. Because of growing interest in *organology*—the study of musical instruments—and the formation of world instrument collections in museums in Europe and the United States, there arose a need for a classification system that could be used to document any instrument. The German musicologist Curt Sachs, in collaboration with Erich von Hornbostel, devised one such scheme in 1914.

The Sachs-Hornbostel system has been more widely used than any other during the twentieth century.⁶ The categories were divided according to the physical characteristics of sound production into *chordophones*—instruments with one or more strings stretched between fixed points; *aerophones*—instruments in which air is the principal means of vibration; *membranophones*—instruments which vibrate by means of tightly stretched skins or membranes; and *idiophones*—instruments sounded by the substance of the instrument itself. In response to rapidly changing technology, Sachs added *electrophones* as a fifth category in 1940. These five general divisions—*chordophones*, *aerophones*, *membranophones*, *idiophones*, and *electrophones*—were further divided into increasingly narrow subcategories.

While the Sachs-Hornbostel system is used internationally by museums and music scholars, there are a wealth of other instrument classification systems that exist worldwide. Some of these schemes are subject to extensive written theory while others exist as part of an oral tradition. The Chinese have perhaps the oldest documented tradition that may date back to 2000 BCE. An early four-part system and a later eight-part scheme classified musical instruments by the substance from which they were made and in relation to nature and religion:

The earliest known principle by which the Chinese classified musical instruments or sources of sound (*yin*) was according to the materials of which they were made. The choice of character was based on the link in the sphere of cosmological thought and ritual between these materials and the seasons, the winds, the abundance of grain, and, by extension, human welfare, wealth, and political power.⁷



▲ The Woodblock, an Idiophone

The eight-part system, known as *pa yin*, included instruments made of metal, stone, silk, bamboo, gourd, clay, leather, and wood. These were ranked in terms of their extra-musical benefit to the human spirit:

The early ideas about instruments were based on the elemental belief in the “breath” or “spirit” that enabled sounds and instruments to serve as manifestations of nature as well as prognostic aids, performing magical services that could benefit the harvest, divine the enemy’s morale, and so on. Instruments made from the eight materials each controlled one of the dances performed at ritual mimes that in turn could summon one of the eight winds.⁸

The ancient Greeks and European theorists in the Middle Ages and Renaissance also classified musical instruments in terms of their effects on nature and the human spirit. The Greek notion that music was directly associated with the movement of the planets—the music of the spheres—was used by Pythagoras to illustrate harmonic proportions, as well as to explain the cathartic and ethical power of music. The Greeks had a three-part classification system dividing instruments into strings, winds, and percussion, but considered the first two to be more beneficial to man:

Moreover, as the sounds of stringed and wind instruments were considered to be analogous to the music of the spheres, these instruments were believed to influence the human soul through its sympathetic responses to them. . . . These associations and analogies persisted in Greek culture for about a millennium and were eventually transmitted into medieval European thought as well.⁹

Medieval theorists also viewed music as an edifying force and linked it to cosmological beliefs. Perhaps the greatest exponent was Boethius who categorized musical sound into a three-part structure: *musica mundana* which included sounds made by the movements of the planets, the elements, and the changes of the season; *musica humana* which was music humans could hear; and *musica quae in quibusdam constituta est instrumentalis* which related to music theory and its application to instruments.¹⁰ Like the Greeks, the medieval theorists believed in the superiority of the human voice, and ranked the three classes of instruments in order of importance—winds, strings, and percussion. Music was intimately related to Christian doctrine and its moral effect on the human spirit.

The earliest extant classification system that distinguishes instruments by their physical sound is found in the Sanskrit treatise, *Natyasastra*, composed in India between the second century BCE and the sixth century CE. Instruments are categorized into four divisions indicating the physical

sound producing characteristics of the instrument's body: stretched (*chordophones*), covered (*membranophones*), hollow (*aerophones* such as flutes and reeds), and solid (*idiophones*, such as bells and cymbals). Each of the four categories are further subdivided into major and minor limbs. Unlike its Chinese, Greek, and early European counterparts, this fourfold scheme is unrelated to cosmological belief. It is still in use in India today, and is believed to have influenced Sachs and Hornbostel in the creation of their system in the first decade of the twentieth century.

These examples describe only a few of the instrument classification systems that have developed historically or are in use today. For the purposes of this book, we will use the Sachs-Hornbostel scheme in order to look at instruments and instrumental timbre in several world cultures. We will then conclude the chapter by devoting a separate section to timbre in vocal musics.

TIMBRE IN WESTERN CLASSICAL MUSIC: INSTRUMENTS IN THE SYMPHONY ORCHESTRA

The contemporary symphony orchestra is divided into four basic groups: strings, woodwinds, brass, and percussion. Each group is further divided into sections: strings include first and second violins, violas, cellos, and double-basses; winds include oboes, flutes, piccolo, clarinets, bass clarinet, English horn, bassoons, and contrabassoon; brasses include trumpets, French horns, trombones, and tuba; and percussionists play a variety of struck instruments including timpani (kettle drums), woodblocks, and keyed percussion such as the glockenspiel. Sections are seated together to facilitate tuning, as well as timbral blending, with the quieter instruments, strings, seated nearest to the audience and the loudest, percussion, brass, and winds, seated behind. Large modern orchestras may be composed of eighty or more players, with up to sixty-eight string players, twelve wind players, nine brass players, and four percussionists.

The symphony orchestra has changed over time. The typical Baroque orchestra at the time of Bach, Vivaldi, and Handel was essentially a string ensemble of under thirty players with a harpsichord or organ used for accompaniment. Woodwinds were sometimes added, but they were not a fixed part of the orchestra. Brass and timpani were used mostly for festive occasions. By the Classical era (1750–1825) the orchestra, although much smaller than its contemporary counterpart, had the same standardized instrumentation that it has today. In the nineteenth century, the orchestra was expanded to reach its present form.

Orchestral Strings ►



Chordophones: Stringed Instruments

The main chordophones in the symphony orchestra are the bowed members of the violin family—the violin, viola, violoncello, and double bass. This family emerged in its present form in the early part of the sixteenth century. Almost every European country has made claims to the invention of the violin, but there is little doubt that it was preeminent in Italy at this time. The accepted modern form of the violin was in place by 1710, largely due to the work of the northern Italian instrument maker, Antonio Stradivari. The violin has since become an important instrument in many traditions outside the European classical world, including in North and South Indian classical music, Arabic classical music, and many European and American folk and traditional genres. The word “fiddle” is often used to colloquially refer to the violin, and is actually the more common term in many folk traditions.

The violin consists of four strings that are tuned in intervals a fifth apart. The framework of the body has a six-rib structure that corresponds to the six main curves of the instrument. The shape and height of the archings, the wood used, the finished thickness of the wood, and even the final coats of varnish are fundamental factors influencing its tone quality. Different combinations of oils and resins give violins different degrees of hardness and flexibility; a good varnish is supposed to allow the instrument to speak with its full voice.¹¹ The table or front of the violin has two sound holes called “f holes”; the back is constructed from one or two pieces of matching maple. The strings are attached to four tuning pegs—usually made from rosewood or boxwood—and run down the unfretted neck of the instrument over a bridge that is held on only by the pressure of strings. In order

to produce different pitches, players stop the strings on the neck with their left hand fingers while holding the bow with the right hand.

The modern violin bow is concave shaped and strung tightly with horsehair. Resin is applied to the bow in order to make it glide more evenly over the strings. The player's method of bowing is a critical component of the resultant timbre. Violinists can play on a continuum from long smooth strokes to short staccato strokes. They can even produce more than one pitch at a time by bowing two strings simultaneously. Players can also dispense with the bow in order to pluck the strings with their fingers. This method of articulation is called *pizzicato*.

The violin's wide range and rich palette of tone colors make it into an extremely versatile solo and ensemble instrument. This flexibility is one reason why the violin has become a staple instrument in so many diverse cultures. Its range and warm tones can be compared to the human voice, and yet it is capable of producing extremely harsh and strident timbres if required. The instrument also blends well with other violins—ten or more players in an orchestra's violin section often sound like one voice.

The other instruments in the violin family are in progressively lower ranges. The viola is several inches longer than the violin and is in the tenor range. Its timbre tends to be more mellow than the violin, although it is capable of loud and powerful passage work. The violoncello, commonly called the cello, has the richest sound of the violin family. Cellists play in a seated position with the large body of the instrument between their legs. The cello is used for solo playing as well as for accompaniment. The bass—also called the string bass or double bass—is the largest member of the family. It is usually played while standing or sitting on a stool. While it is conventionally bowed for classical repertory, it is most often plucked when used in jazz.

Violins, violas, and cellos are not only the most plentiful instruments found in the modern symphony orchestra, they are also commonly grouped together in the string quartet. The string quartet features four musicians—two violinists, one violist, and one cellist. Composers since the early nineteenth century have been inspired by the timbre and texture of this particular combination of string instruments and have written many works for string quartet.

Aerophones: Wind Instruments

Wind instruments depend on a column of air pushed through a tube at a higher pressure than air outside; the resulting column vibrates like a string. The air column's fundamental frequency depends on its length,

but the overtone structure varies with the shape of the column. Instruments with a conical bore—saxophones or oboes—have an even distribution of overtones; the cylindrical bores of flutes and clarinets suppress some overtones; and the flared bell shape in brasses tends to favor high-frequency overtones.

The column of vibration is initiated in different ways according to the instrument. In flutes, the player's breath interacting with the sharp edge of the mouth hole causes the column of air in the tube to be set in motion. In oboes and clarinets, the vibration is caused by the movement of a reed—a thin sheet of cane that vibrates between the lips. Clarinets and saxophones use a single reed which fits into a mouthpiece, while oboes and bassoons have double reeds that when held directly in the player's mouth, vibrate against each other. Players of brass instruments activate the vibration with their lips pressed against a cup or funnel-shaped mouthpiece. The shape of the mouthpiece also affects the timbre of the instrument.

In the symphony orchestra, wind instruments are divided into woodwinds and brass. The three woodwind instruments—flutes, clarinets, and oboes—have approximately the same range, but quite different tone colors. The modern silver flute has a very clear quality due to its limited overtone structure. The clarinet, usually made of ebony, is capable of warm, rich, and mellow tones that often resemble the human voice. It has the most expressive and dynamic range of the woodwinds. The oboe, with its double-reed structure, has a much more crisp and penetrating sound than the clarinet.

Each of these three instruments has higher and lower counterparts in the orchestra, including the piccolo, the smallest and highest member of the flute family, the small E-flat clarinet, the bass clarinet, and the English horn—a larger oboe which plays in the viola range. The bassoon is in the cello range and with its double reed, has characteristics similar to the oboe. The instrument's long tube is bent back on itself and the reeds are brought close to the player's mouth by means of a narrow metal tube. The double bassoon or contrabassoon is more rarely employed in the orchestra; its range is an octave below the bassoon.

The brass instruments in the symphony orchestra include the trumpet, French horn, trombone, and tuba. The loudest of the wind instruments, they are made of metal and have long tubes that are coiled. Brass players create the pitches of the overtone series by adjusting the pressure of their vibrating lips within the mouthpiece of their instrument. The trumpet is the highest of the brass; it is made with a funnel-shaped mouthpiece and narrow bore that flares at the end into a bell. The modern trumpet is con-

structed with three pistons or valves that when deployed allow air to pass through additional lengths of tubing, thereby giving players access to all the pitches of the chromatic scale. The bright color of the trumpet can be changed by inserting different shaped mutes into the bell.

The modern French horn is constructed from a long coiled tube, and like the trumpet, has valves to add additional tonal possibilities. It has a lower and more mellow tone than the trumpet, and is used to play solo parts and to enrich the overall web of color in the orchestra. It has also a great dynamic range and as with the trumpet, mutes can be used to change its tone color.

The trombone has a cylindrical bore and a cup-shaped mouthpiece, and is operated by a sliding mechanism rather than valves. The length of the instrument is increased by means of the slide which gives the instrument a larger range of pitches. Both the tenor trombone and the bass trombone are found in the contemporary orchestra. Trombones have a wide range of tone colors, ranging from noble, solemn, and voice-like to staccato, hard, and powerful.

The tuba is the lowest of the brass instruments and is constructed with a wide conical bore and a cup-shaped mouthpiece. The tuba family first came into existence in the mid-nineteenth century. Wagner's use of the instrument in the late 1860s established its place in the symphony orchestra. Both the tenor and bass tubas are operated with valves, but do not have the pitch range of the other brass instruments. Like other bass instruments, they are typically used to play accompaniments rather than solo parts.

Percussion Instruments: Membranophones and Idiophones

Percussion instruments include membranophones—the many forms of drums that are constructed with some sort of stretched skin over a resonating body—and idiophones, instruments whose bodies create sound without the aid of strings or skin. Idiophones can be struck with mallets, such as xylophones, glockenspiels, woodblocks, triangles, steel drums, bells, and all the bronze or iron gongs and barred instruments of the central Javanese gamelan. Other idiophones can be scraped—such as the Latin guiro, or shaken—such as the maracas or rattle. Some idiophones and membranophones are tuned to exact pitches, while others have no fixed pitch.

The timpani have been the main percussion instruments in the symphony orchestra since its inception. The contemporary timpani consist of a set of three to five tunable kettledrums played by one player. The

drum body is a large bowl of metal over which a skin or synthetic head is stretched. The chief use of the timpani is to provide punctuation and tone color. Before Beethoven's time, the drums were used dramatically and ceremonially in loud passages in combination with brass. The refinement of the instrument in the early nineteenth century gave composers the opportunity to use it in new ways. Hector Berlioz was perhaps the first composer to thoroughly investigate how different drum mallets affected tone color on the timpani. Because they are tuned to precise pitches, timpani are used to play bass lines and more occasionally, melodic passages. Players often have to change the tuning of their instruments within a single piece.

Up until the twentieth century, percussion instruments played a relatively small role in the orchestra. Composers used percussion mostly for punctuation, to highlight or intensify certain passages, and for novelty. By the 1940s, some composers who were influenced by many musics from non-Western cultures, as well as by jazz and popular music, began to write compositions using a lot of percussion in the form of marimbas, vibraphones, xylophones, bells, gongs, cymbals, and drums.

Tone Color and Composition



Beethoven's Symphony No. 5 in C minor, First Movement. As you listen, notice how changes in timbre help to create movement and mood, including the use of the timpani and alternation between instrumental choirs.

Each instrumental group of the orchestra may be regarded as a separate "choir" of instrumental voices, with its own distinctive timbre—the woodwinds create a particular timbre when sounded together, as do the brass or strings. Instead of hearing individual instruments, one hears a composite sound that has a definite tone color. In orchestrating their compositions, composers use timbre by contrasting one section against another and one choir against another. The possible interplay and contrast between the sound of a solo instrument, one or more sections, individual choirs, and the entire orchestra provide unlimited possibilities for the use of timbre in orchestral composition.

Composers have written for all kinds of smaller ensembles that make use of the instruments of the contemporary symphony orchestra. The separate choirs of the orchestra—strings, woodwinds, and brass—have served as inspiration for composers in the form of the woodwind quintet, string trio, string quartet, and brass quintet. Many other combinations of instruments have been used in chamber music. Unlike orchestral music, chamber music is composed for a small group of musicians—generally two to nine—in which each musician has his or her own part. While the timbres of a large group tend to blend together, the tonal nuances of each instrument can be more readily distinguished in chamber music performances.

TIMBRE IN INDIAN CLASSICAL MUSIC

In many cultures, small ensembles are the primary means of musical expression. In the performance of North Indian classical music, small groups, including one or two instrumental or vocal soloists, a percussionist, and a musician playing a drone instrument called the *tanpura*, are common.

Indian musicians and dancers regard vocal music as the fountainhead of the arts, and in important respects Indian melodic instruments are designed to imitate aspects of the human voice. Plucked instruments such as the *veena*, *sitar*, and *sarod*, bowed instruments such as the *sarangi* and violin, and blown instruments such as the bamboo flute and *shahnai*, are constructed to emulate the pitch range, volume, ornaments, and timbre of Indian classical singing. Drone instruments such as the stringed *tanpura* are designed to accompany both singing and instrumental music, as are percussion instruments such as the *tabla*, *pakhawaj* or *mrdangm*, and hand-held cymbals.

Classical Instruments of North India

strings:		winds:	drums:
<i>plucked</i>	<i>bowed</i>	<i>blown</i>	
sitar	sarangi	shahnai (reed "oboe")	tabla
sarod	esraj	bansuri (bamboo flute)	pakhawaj
surbahar	violin		
Rudra-vina		<i>bellows-blown</i>	
slide guitar		harmonium	
tanpura			

Many additional varieties of stringed instruments and hand percussion are used to accompany folk and devotional music.

The traditional settings of classical music performances, solo or small ensemble recitals for audiences of knowledgeable listeners in the temples and courts, lent themselves to an intimate style of singing. A singer did not need to sing loudly, but subtle pitch inflections, ornaments including glissandos (slides), shakes, and grace notes, sophisticated rhythmic play, and an individualistic vocal timbre which emphasized the emotion of the sung text, were (and remain) high priorities.

The twentieth-century advent of concerts in large public halls more or less coincided with the introduction of microphones and electric sound amplification, so Indian singers and instrumentalists have been able to retain their emphasis on an intimate approach appropriate to what in the West would be called chamber recitals. This “chamber music aesthetic” applies to all Indian classical instruments except outdoor instruments such as the powerful South Indian *nagaswaram*, whose reedy sound accompanies religious processions which may be attended by thousands of devotees.

Chordophones: Plucked Instruments

Statues and portraits of Saraswati, the Hindu goddess of learning and the arts (particularly music) depict her as a musician, holding the *veena*, which may be regarded as the quintessential Indian classical instrument. A plucked, fretted lute, the *veena* is capable of producing pitches in the full three-octave range that is theoretically (and, in some cases, literally) used by Indian classical singers. A very ancient instrument, the *veena* remains to this day the most popular fretted instrument among South Indian classical musicians.

In North India, the *veena*—also called *been*—has largely been supplanted by the *sitar*, the most common fretted instrument in North Indian classical music. The *sitar* seems to have become the instrument of choice in North Indian court music during the eighteenth century.¹² The great virtuoso Ravi Shankar introduced the *sitar* to many listeners in the West via concert tours and recordings, beginning in the early 1960s. Millions of Westerners became familiar with the sound of the *sitar* during that decade when popular bands like the Beatles began incorporating the instrument as an intriguing “new” timbre in rock recordings.

A number of structural features of the *sitar* give it a timbre which contrasts markedly with those of Western plucked instruments like the guitar, banjo, and mandolin. The sound of a vibrating string on a guitar or *sitar* is transmitted to the resonant body of the instrument by a wooden, bone, plastic, or metal bridge, which sits on the instrument's sound-board, directly beneath the taut string. On most Western instruments, including not only the guitar but also the mandolin, banjo, and the violin family, the point where the string crosses the bridge is a narrow ridge, less than an eighth of an inch across. This one-pointed transit gives the instrument a very sharp, clear sound. When the bridge becomes worn or damaged, causing the string to travel across an unusually wide or depressed surface, the result is an undesired muted or buzzing timbre, and the bridge requires repair or replacement.

In contrast, the sitar has a very wide, almost flat bridge. The string crosses a surface of half an inch or more. The bridge is carefully shaped into a gentle curve, which is designed to add a buzzing timbre to the sound of the string. This kind of buzzing, which Western instrument makers work very hard to prevent, is a desired quality in the sound of a sitar. This buzzing is an important part of what Indian musicians call the *jawari* or "voice" of the instrument, and when the bridge becomes worn, repair is required to restore the instrument's *jawari*.

Guitars, mandolins, violins, violas, cellos, and double basses all transmit their sound to the listener in part through round or f-shaped holes in the surface of the instrument. Sound vibrations bounce from the back wall of the instrument through the soundhole and towards the listener. The sitar, like many other Indian stringed instruments, has no sound hole. Unlike the



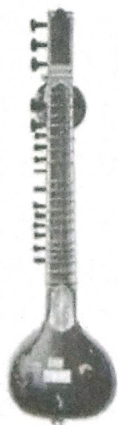
Tanpura



Sarod



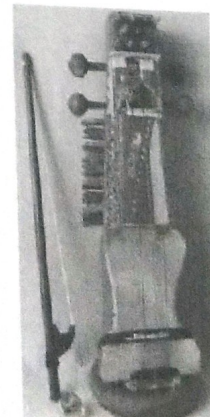
Pakawaj



Sitar



Tabla



Sarangi

guitar, which has a single resonating hardwood body and a solid wooden neck, the sitar has a gourd resonator at its base, a hollow, resonant wooden neck, and in many cases a second gourd resonator attached near the upper end of the neck. Thus, the resonance of the sitar has a different quality than that of a guitar. The sound of the sitar seems to permeate the performance space, instead of bouncing from the instrument towards the audience.

Readers who are familiar with the guitar know that the instrument sounds particularly resonant in certain keys, such as E major or E minor, A major or A minor, D major or D minor, and G major. The reason for this lies in the principle of sympathetic vibration. When a particular note is sounded near to a string tuned to the same pitch, or one of its prominent overtones, the second string will vibrate “in sympathy” with the sounding note. The open strings of the guitar are tuned to the notes E, A, D, G, B, and E. When the note E is played on the guitar, two additional open strings (E and B) vibrate in sympathy with the plucked string. The same phenomenon occurs when the notes A, D, or G are played.

Sitar-makers take advantage of the principle of sympathetic vibration by including nine or more sympathetic strings in the construction of the instrument. Most sitars have seven playing strings, which run over a set of curved metal frets. These are the strings which are played to produce melodies and rhythmic drones in the course of a performance. The sympathetic strings lie *beneath* the frets. They are tuned to the notes of the raga being played, and are rarely plucked in the course of a performance. Their function is to enhance the resonance of the playing strings by vibrating in sympathy with the sound of the plucked notes.

The buzzing timbre of the sitar, the fact that its long neck functions as a resonating chamber, the indirect diffusion of its sound, and the resonant quality of its sympathetic strings result in a very different timbre than that of Western plucked instruments. Readers who are unfamiliar with the sound of the sitar may seek out commercially available recordings by internationally renowned artists such as Ravi Shankar, Vilayat Khan, and Nikhil Banerjee.

The North Indian *tanpura* shares many structural and timbral qualities with the sitar, including a wide bridge, a gourd resonator at its base, and a hollow, resonant neck. Unlike the sitar, the tanpura has no frets or sympathetic strings. The function of the tanpura is not to provide a melody, but to sound a continuous accompanying drone by the sequential plucking of its four, five, or six open strings. The buzzing of the strings is enhanced by the placement of slender threads of cotton or silk between each string and the bridge.



A North Indian tanpura
played by Ira Landgarten.

The North Indian *sarod* is, like the sitar, a plucked, melodic instrument, used by soloists in the performance of Hindustani classical music. Like the sitar, the sarod has a hollow, resonant neck, and utilizes sympathetic strings to enhance the instrument's resonance. Unlike the sitar, the sarod has a tight goatskin head beneath the bridge, rather than a wooden soundboard, and a fretless, metal fingerboard, rather than metal frets, mounted on its neck. The sound of the sarod is more percussive, clear, and metallic than that of the sitar.



Buddhadev Das Gupta
performs the gat in Rag
Kamod on the sarod.

Wind Instruments: Bansuri and Shahnai

The North Indian bamboo flute, or *bansuri*, is very simple in its construction, consisting of a piece of bamboo close to two feet in length, closed at one end and open at the other, with a soundhole near the closed end, six finger holes, and occasionally one or more unfingered tuning holes near the open end of the instrument. The bansuri is a transverse flute, that is, the player blows across the soundhole from the side.

The Hindu god Krishna is often pictured playing the bansuri, and many songs and stories tell of the seductive power of his playing. The flute is considered a highly romantic instrument in India. The timbre of the instrument is high and "pure," but perhaps warmer and darker than that of most metal flutes.

The *shahnai* is an end-blown reed instrument, with a piercing tone quality and open finger holes that allow performers to slide gracefully from note to note, emulating the glissandos and ornaments of North Indian classical singing. Like the South Indian nagaswaram, the shahnai is associated with temple music, and is frequently played for weddings.

Percussion Instruments

Contemporary performances of North Indian classical music are usually accompanied by the paired hand drums called *tabla*. The right hand drum in a pair of tabla, called the *dahina* or *tabla* (the same name used for the drums as a pair) consists of a tapered wooden cylinder from nine to twelve inches high, with a diameter at the upper, narrow end of four and three-quarters to six inches. The left hand drum, called the *bayan*, is a hemispheric kettle drum eight and three-quarters to eleven inches high, with an upper diameter of eight to nine inches.

Both drums are covered with heads of goatskin, with a narrow second skin placed over the first in a half-inch band around the rim of the drum. On each head is mounted a black dot, two and three-quarter inches

in diameter, composed of paste and iron filings, called a *siyahi* ("ink").¹³ The main skin on each drum, which is visible between the rim and the centrally placed *siyahi*, is called the *sur* ("note" or "keynote"). The second skin, which is mounted around the rim of the first, is called the *kinar* ("bank" or "edge").

Both heads are held taught by leather thongs, which are threaded through the edge of the head and strung back and forth between the top and the bottom of the drum. The *kinar* and *sur* of the right hand drum are tuned precisely to the keynote "sa" by the manipulation of wooden pegs placed under the thongs and the gentle hammering of a leather rim around the outside circumference of the head. Under the skilled fingers of a master drummer, the *kinar* produces overtones which emphasize the "sa" one octave above the "sa" played on the *sur*. The sound produced on the *kinar* is called "na"; the *sur* produces "tin." The *siyahi* produces a bell-like, ringing tone called "tun," with overtones that ring one whole-step above "sa." The *siyahi* may also be muted, producing a short, unpitched, "dry" sound called "te," without the ringing quality of "tun."

The skin of the *bayan* is tuned less precisely and more loosely than that of the *dahina*. When allowed to ring, the *bayan* produces a deep, bass sound called "ge," which can be made to imitate the inflections of speech by adjusting the pressure of the heel of the left hand against the vibrating head. The *bayan* may also be made to produce muted, "dry" sounds called "kat" or "ke."

Indian percussion instruments include a wide variety of cylindrical drums such as the *mrdangm*, *pakhawaj*, and *dholak*, frame drums such as the *daff* and *kanjira*, and cymbals of bell metal such as the *manjira*.

TIMBRE IN JAPANESE TRADITIONAL MUSIC

In much of Japanese traditional music, performance is centered around a solo instrument or a small ensemble consisting of voice, *shakuhachi* (an end-blown bamboo flute), *koto* (a rectangular zither), and/or *shamisen* (a three-stringed plucked lute). Unlike the hierarchical structure in North Indian classical music which features a soloist accompanied by two other musicians, Japanese musicians play and sing the same part within the small ensemble. Timbres also differ markedly. In North Indian *sitar* and *sarod* performance, the presence of drone and sympathetic strings create both a continual web of sound and a buzzing tone color. According to ethnomusicologist and *shakuhachi* player Tomie Hahn, Japanese aesthetics call for more clarity and simplicity of line and subtlety of tone color:



Percussionist Ray Spiegel illustrating the timbre of the *tabla*. Listen to the ringing, almost bell-like quality of the *dahina*, and the vocal, bass sonority of the *bayan*.

One of the concepts in Japanese music that I believe is really different than in other styles of music around the world is the beauty of simplicity. In a sense, the clean, very clear, yet subtle line is really to be appreciated as an aesthetic. . . . We can even see this in architecture . . . and in gardens, in bonsai, this really clear line. This is something very obvious in the single line of the shakuhachi where we see, actually can hear the shapes of the sound. . . . In the ensemble when shakuhachi and koto or shamisen are playing together we will have these beautiful simple lines passing by . . . yet there are nuances particular to each instrument.

Particularly in Japanese music this [timbre] is something we really love—that full palette of sound. To have everything from a really rough [tone color] to a very clean, beautiful, clear, clear sound. We want all of this variety and this is what colors the music. This is what makes the subtleties ring throughout the piece.¹⁴

The Shakuhachi

Of all the instruments in Japanese traditional music, perhaps the shakuhachi displays the widest range of tone colors, which are achieved through the player's breathing and articulation:

In shakuhachi music, the subtleties are what is to be appreciated and various timbral changes. . . . Shakuhachi has such a palette of different color sounds. For example, we have a strong bell-like sound on the one hand, a very large round sound, and then we have no pitch way on the other side, just air coming out of the shakuhachi. What we want is everything in between, the entire palette of sound.¹⁵

The shakuhachi is thought to have come from China in the eighth century with Buddhism. It was later adopted in the seventeenth century by itinerant Buddhist monks who used the instrument to play for alms and as an aid in meditation. The production of a single tone was believed to bring the player closer to enlightenment. According to Hahn, "Within one note there is a whole microcosm, a whole world of sound. The subtleties are endless." This appreciation for the timbral possibilities of one tone explains why each articulation—including silence—is so important in the aesthetic of shakuhachi playing.

The instrument is made from bamboo that has large joints, and both the stalk and root are used. The bamboo is heated in order to straighten it out and shape it with the bell given a slight upward curve. The bamboo is then stored for six months which allows water and oil to evaporate. It is then hollowed out with a rasp and finger holes and a mouthpiece are cut.



"Hifumi Hachi Gaeshi"
played on the shakuhachi.

A piece of water buffalo horn or ivory is inlaid into the blowing edge, and finally, the bore is given five coats of black or red lacquer.

The instrument is played vertically with the lower lip almost covering the mouthpiece opening. The stream of air strikes the horn inlay of the mouthpiece and enters the flute. Very little air is needed to produce a tone, but excess air is sometimes desired to create the airy and strong explosive sounds that are characteristic of the playing style.

The Koto

The koto is the Japanese member of a family of long zithers with movable bridges assumed to have originated in China. The wooden body of

▼ The Koto



the koto is long and rectangular and the instrument is played sitting or kneeling on the floor. It has thirteen silk strings that are strung horizontally at equal tension. The desired pitch of each open string is determined by placing a movable bridge made of ivory, bone, or plastic, at a specific point under it. Different tunings are created by moving the bridges. Players traditionally stop the string above the bridge with the fingers of their left hand to create additional pitches. They use ivory, bone, or bamboo picks on the thumb, forefinger, and middle finger of their right hand to pluck the strings. The main playing finger is

the right hand thumb. In contemporary music, the left hand is also used to pluck the strings, giving the instrument an almost harp-like sound.

The koto has an astonishing range of subtle tone colors that are achieved by the player's plucking techniques. Musicians can play a very scratchy style across the strings, or with the picks they can repeatedly strike one string after another to make a continuous, beautiful, almost water-like, flowing sound. With their left hands, they can bend or hammer on the string in order to produce a pitch without plucking.

Sawai Tadao composed the solo koto piece "Tori No Yo Ni" in 1985. The composer used the image of flying as his inspiration. He wrote, "How would it feel to fly free in the sky as a bird flies? Humans have invented airplanes, but we are not free to feel the clouds as we pass through them." Sawai achieves the sense of flying by having the player repeatedly play one string after another, using both hands to pluck the strings. Listeners will notice changes of timbre—even when a single note is repeated—and should keep in mind that tone color and dynamic range are closely related.



A contemporary composition for solo koto by Sawai Tadao entitled "Tori No Yo Ni."

TIMBRE IN ARABIC CLASSICAL MUSIC

Much of Arabic art music is performed by a soloist or by a small ensemble of musicians. In Arabic music, as in India, vocal music is often regarded as the fountainhead of the arts, and in important respects, instruments are designed to imitate aspects of the human voice. Both the singing and instrumental styles include a high amount of ornamentation and little or no vibrato.

The ensemble of 'ud (a short-necked lute), qanun (a plucked zither), violin, and nay (an endblown flute), accompanied by either the darabukka (a goblet-shaped drum) or daff (tambourine) is used to play the principle of form of Arabic art music known as *nawba*.¹⁶ While all the melody instruments play the same musical line, this combination of blown, bowed, plucked, and struck instruments provides a wide palette of musical timbres.

The 'Ud

The 'ud, ancestor of the Western lute, was and still is considered the cornerstone of Arabic music and “the Sultan of Musical Instruments.”¹⁷ Played both as a solo and an ensemble instrument, the 'ud is a short necked lute with a pear-shaped construction that has a long history in the Arabic world. The word “'ud” literally means wood. Musician Simon Shaheen describes the instrument:

The 'ud is actually the most prominent instrument in Arabic music and it is as valuable as the piano is for the Western composer. It has five double strings and one single low string. And it has a finger board that is fretless, and this is how the quarter tone quality is



◀ The Violin and 'Ud

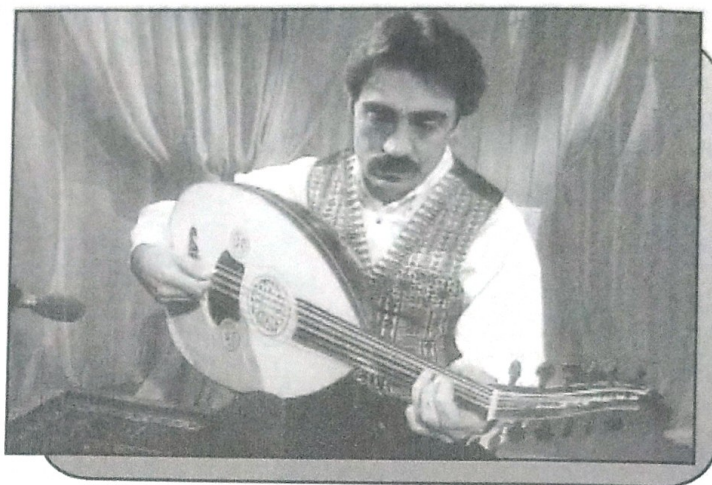


Simon Shaheen and ensemble performing “Dikrayati” using violin, 'ud, nay, and daff.

The 'Ud ►



Simon Shaheen plays a solo taqasim on the 'ud. Taqasim are non-metric instrumental improvisations for a solo instrument or solo instrument with percussion accompaniment. In this example, Shaheen is accompanied by Michel Merhej on the daff. This taqasim is explained more fully in Chapter 11.



produced. . . . The fact that we don't have frets on the finger board like on the guitar or the lute makes it possible to produce the microtonal qualities or any qualities of sound.¹⁸

Like all lutes, the 'ud is a chordophone that has a neck that acts as a string bearer. The strings are strung from near the base along the full length of the neck. All lutes have both a resonating body with soundholes and a neck, although instruments differ according to relative length of body and neck, shape of the back, number of strings, and whether they have frets or not. The 'ud has a narrower neck than the Western lute, three large circular soundholes, and a tortoiseshell plaque.

The documented history of the 'ud goes back to the fifth century, when the instrument was reported to have a skin top and three strings. This skin top was later replaced by a wooden top, and by the end of the sixth century, the 'ud had four strings and four frets. In the ninth century, the 'ud was reported to already have five strings. It was the instrument most discussed by the classical theorists in the ninth and tenth centuries who combined Greek, Persian, and Arabic concepts to contemplate both the technical aspects of music—scales and modes—and the cosmological. The 'ud was portrayed as a microcosmic representation of man's physical, mental, and spiritual states.

The work of al-Kind, the first important theorist whose work survives today, analyzed intervals and scales in terms of fretting on the 'ud, as well as cosmological concepts derived from the Greeks, comparing the 'ud's original four strings to the zodiac, the elements, the seasons, and four humors. The fifth string was thought to symbolize the soul.¹⁹

In the ninth century, the 'ud was brought to Spain which was part of the Islamic world. It appeared in other parts of Europe by the thirteenth

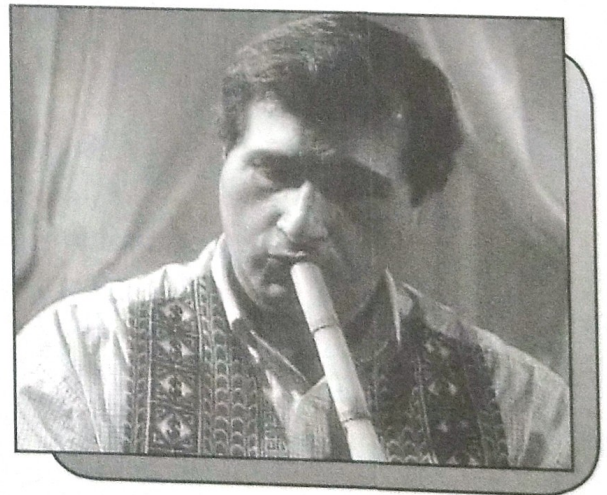
century where it developed into the lute, one of the most important instruments of the European Renaissance. The word “lute” evolved directly from the Arabic “al’ud.” The Renaissance lute was shaped like the ’ud, but had frets and was played with the fingers rather than with a plectrum.

Today, the ’ud is usually played in the context of a small ensemble, as accompaniment to a vocalist, or as a solo instrument. It is the most widely used instrument in both art and popular music ensembles throughout the Islamic world. It is plucked with a feather-like plastic plectrum, a modern substitute for the eagle feather quills originally used. The strings are plucked in regular or irregular upward or downward motions. The player must know both repertoire and plucking techniques which help to give the instrument its wide variety of timbres. ’Ud players change between the high and low registers, repeatedly pluck the high open string to create a drone, and simultaneously play one or more melodies.²⁰

The Nay

The nay, an endblown flute made from cane, is a Persian term meaning pipe, and versions of the instrument are found from North Africa to western China. The instrument is used throughout the Arab world as both an ensemble and a solo instrument. Nays are constructed in different sizes, but in all cases, musicians blow against the sharp edge of the pipe opening to make a sound. According to Fred Stubbs, it is the mouthpiece that differentiates one type of nay from another:

▼ The Nay



The Turkish nay is different from the Iranian nay or the Arabic nay because of its embouchure. This mouthpiece is what actually touches the lips, and it’s a little bit more complex than the Arabic style. The Arabic style ends without a cap and the Persian nay has a metal sleeve on it. . . . The Turkish nay is the only one to have a mouthpiece usually made out of ox horn. . . . It is this shape that is said to give the Turkish nay its particular tonal timbre.²¹

The nay generally has six finger holes on the front and one in the back. Through overblowing, musicians can get a range of three octaves. The lips and head position must be changed while blowing and opening or closing the finger holes.

In Turkey, the nay is a central symbol for the Mevlevi Dervishes, a Sufi order whose patron saint is the great poet Rumi who died in the fourteenth century. Stubbs said, the Mevlevis’ recreation story about the nay is symbolic of the human condition:



Bassam Saba plays a taqasim on the Arabic nay. [Additional listening information is at the end of the chapter.]

The nay is first cut from the reed bed and then it is pierced with the number of holes in the human body. And at the moment that the nay is made hollow or empty, which happens by means of a hot poker, it is said that the nay then begins to scream or sing or to cry out to be reunited with the beloved. And so the nay is a powerful instrument for the Mevlevis. It's not a magic instrument. Playing the nay expresses something about the human condition. It expresses that the human condition is temporary, and that our natural condition is to long for a reuniting with our source, with the universal power, with God. . . .²²

TIMBRE IN MUSIC FROM SUB-SAHARAN AFRICA

The many countries that lie south of the Sahara Desert utilize an enormous variety of musical instruments. All types of chordophones, aerophones, membranophones, idiophones, and electrophones are represented, ranging from traditional hand-crafted string, wind, and percussion instruments to mass-produced imports from the West. In many popular urban genres, indigenous instruments are used in combination with acoustic and electric guitars, electric bass, synthesizers, brass instruments, and accordions, to create contemporary musical fusions such as Nigerian *jùjú* and *chimurenga* from Zimbabwe.

The Mbira

Although there are countless varieties of drums of all shapes and sizes found throughout sub-Saharan Africa, other instruments are equally important. One of the most popular is the *mbira*, also known as the *sanzi*, *likembe*, *kalimba*, or thumb piano. The range of this keyboard-type idiophone, belonging to a general class of instruments called lamellophones, extends from South Africa to Ethiopia in the east and the Gambia in the west, but it is found in greater concentration in Zaire, Zimbabwe, Mozambique, and parts of Angola.²³ There are many forms and sizes, but all mbiras have basically the same layout and four elements in common: they contain a soundboard, a natural means for amplifying the sound, a set of keys, and a method of producing a buzzing quality.²⁴

According to Paul Berliner, the buzzing timbre is considered an essential and pleasing feature of the music played on the mbira:

This quality is appreciated by African musicians in the same way that Westerners appreciate the sound of the snares on a snare drum

or the fuzz-tone on an electric guitar. It may be seen as analogous to the mist that partly obscures the mountains and small figures of certain Chinese silk-screen paintings: the mist is an integral part of such paintings, establishing mood and feeling, and the figures are not supposed to be seen more clearly. The same is true for the buzzing that accompanies the pure sound of the mbira.²⁵

The buzzing can be produced in different ways, including by placing metal beads around the keys or by attaching shells and more recently, bottle caps, to a metal plate on the soundboard. When the keys are played, these devices vibrate sympathetically, creating a continuous drone-like buzz.

The overall timbre of the mbira differs according to the materials used in its construction. The body of the instrument is usually a rectangular box made from a single block of wood that is hollowed out. The keys are fixed to the soundboard and attached to the back of the bridge. They can be made from iron, copper, steel, brass, stems, bamboo, wire, or nails and range in number from as few as three to as many as fifty-two. For added sound, the instrument is often placed on or in a resonating chamber such as a gasoline tin, bark trough, or gourd. Large instruments are often placed in bowl-shaped calabash gourd resonators.²⁶

The instruments are played in a variety of contexts ranging from pure recreation to religious events. Among the Lemba, a Bantu tribe from the Transvaal, the mbira, known as the *deza sanza*, is considered a sacred and symbolic object which represents the Lemba ancestors.²⁷ Although often used as a solo instrument to accompany a single singer, mbiras are also played in combination with other instruments. Mbira ensembles exist throughout sub-Saharan Africa, including groups of more than fifteen players that play at the religious ceremonies of the Shona in Zimbabwe.²⁸

The Xylophone

The xylophone is another keyboard-type idiophone that is found throughout sub-Saharan Africa. The instrument has many different names, including *balafon*, *madimba*, *mbila*, and *akadinda*, depending on the region where it is found. Most xylophones have wooden keys that are played using wooden mallets; resonators are often used to deepen the timbre and amplify the sound. The instrument's size, shape, and materials vary from region to region. Timbre is affected by the wood chosen for the keys, as well as the size and type of resonators or their absence. Instruments without resonators are appropriate for solo or group playing in an intimate setting. Xylophones are also played in many different instrumental combina-

tions and social settings, ranging from single players to entire orchestras.

The simplest version may be the leg xylophones that consist of three or four bars placed on the extended legs of the player.²⁹ Log xylophones, found throughout Central Africa, consist of two logs that act as support for the keys. Some of these instruments may be long enough to enable two or three musicians to play together at the same instrument. The *akadinda*, a twenty-two keyed instrument from Buganda, is played by six people—three on each side.

The most common type of xylophone has calabash resonators that are fixed under the keys. According to Bebey, the distinctive timbre of this type of instrument comes partly from the construction of the resonator: a hole in each calabash is covered with a substance made from a spider's web, a thin piece of fish skin, or a bat's wing, and attached with resin.³⁰

One example of this type of xylophone is the *balo* or *balafon* from Guinea, Mali, and the Gambia. The balafon usually has eighteen to twenty-one rosewood keys that are arranged on a bamboo frame over gourd resonators of graduated size. Its history is often traced back to the thirteenth century and it has been used by the *jalis* (discussed below) ever since. The well known Malian singer, Salif Keita, recently added the balafon to his electric band.

The Kora

The kora is an instrument unique to the Manding people who live in Senegal, the Gambia, Guinea, and Mali. While chordophones, including harps, are found throughout sub-Saharan Africa, the kora is an interesting combination of parts. It is classified as a spiked bridge harp which

has a skin-covered gourd sound box with twenty-one strings that come off the neck in two rows perpendicular to the soundboard. The strings cross over notches in a high bridge and the long neck passes completely through the soundbox. Like the mbira and many other African instruments, traditional koras often have a metal plate with jangles attached to the bridge. The metal vibrates sympathetically when the strings are plucked, thereby creating a buzzing sound. Because the buzz gets overemphasized when the kora is amplified, the plate is now often removed for recordings and broadcasts.³¹

The kora's tuning is divided between the two rows of strings so that the playing technique often involves the alternate plucking of notes by

▼ The Kora



the left and right hands. The melody results from the interlocking of the two parts. Traditionally the strings were made of twisted hide, but today they are made of nylon in graded strengths. According to Roderic Knight, the bright, clear timbre produced by the nylon strings has helped to make the instrument popular far beyond the areas in which it is indigenous.³²

The kora is traditionally played by *jalis*—hereditary musicians who function as historians, genealogists, and praise singers. The jali uses the kora, balo or balafon, and the *kontingo* (a five-stringed plucked lute with a skin head) to accompany songs. In the past, the verbal skills of the jali were considered important for the maintenance of society:

For example, praises and genealogy were incorporated into songs, and oral history told to the accompaniment of instrumental music. The jalis (Mandinka:jalolu) held important positions next to various leaders and influential people of the state because of their exclusive knowledge and ability in the verbal arts. They were essentially the personal court musicians of these people and they were highly respected and well paid for their important contributions.³³

While there is a large body of repertoire for the solo kora, most of the repertoire involves singing. The importance of speech and song are evident in performance:

At different points in a performance jalolu may tell stories in everyday speech, chant narrative songs associated with specific heroes, sing tunefully, or declaim highly formulaic praises and proverbs. The preferred timbral quality, a forceful chest resonance sung with a tensed throat, evokes the strength of the Mande heroes in sound itself.³⁴

The importance of song in the music of the jalis is evident throughout sub-Saharan Africa where the human voice is often the primary instrument. When instruments are used, they often imitate the contour and even the meaning of tonal languages. Pitched drums can be used to convey complete phrases, messages, or verbal formulas, such as proverbs or praises. The hour-glass drum of the *Yoruba*, for example, reproduces all the tones of speech by the musician's regulation of the leather thongs attached to the skin of the drum.³⁵

TIMBRE IN VOCAL MUSIC

The human voice, perhaps the most mysterious and complex of all musical instruments, works somewhat like a set of bellows-blown bagpipes. The singer inhales through the nose and/or mouth, holds and compresses the air in the lungs, and expels the pressurized air between the vocal cords,

which function as a pair of vibrating reeds. By coordinating the flow of air, the tension of the vocal cords, and the shape of the lips, soft palate, tongue, and air passages, the singer controls pitch, volume, and timbre.

Tone color in the voice, as in all instruments, results from the phenomenon of the overtone series. The singer's body is a wind instrument, but unlike a flautist or clarinetist, the singer can actually control the shape of the resonating spaces within his or her instrument to emphasize desired partials. The chest, throat, mouth, nasal passages, and sinuses act as a set of resonators, amplifying the reedy buzz created by the vibrating vocal cords. The throat, tongue, soft palate, and cheeks are used, either consciously or unconsciously, to shape the resonant space and create desired timbres. Posture, breathing, and the shaping of the throat affect the resonance of the chest cavity.

Although the sinuses and nasal cavities are not directly shaped by muscular action, by the action of his or her muscles the singer can direct sound into or away from these resonators. All parts of the resonating system are therefore under the singer's direct or indirect control, resulting in an enormous variety of possible tone colors. The singer can, in effect, turn her instrument into a flute, saxophone, or clarinet at will, by simply altering the shape of the resonant spaces within his or her own body.

Singers control the timbre of their voices by shaping vowels and hummable consonants. The vowels "ee," "ah," "eh," "oh," and "oo" each require a different shape of the lips, tongue, and cheeks, and this reshaping of the resonant cavity alters the emphasis within the overtone series, creating changes in tone color. Hummable consonants, such as "mm," "nn," "ng," "ll," and "zz" also can be manipulated to create various timbres.

For the sake of discussion, we divide the sound of a single sung note into separate domains of pitch, duration, timbre, volume or intensity, and attack (accented or unaccented), but these are all artificial distinctions, aspects of what the ear correctly perceives as a single sonic event. Our perception of vocal timbre is, therefore, affected not only by the functioning of the overtone series, but by every other aspect of singing. We may be fooled into thinking we have heard a change in timbre when what we really have perceived is a change in volume or pitch, but even this is not the whole story. The timbre of a singer's voice actually does change, not only when he or she alters the shape of a sung vowel, but also when he or she makes changes in pitch, volume, or attack.

The actions of the vocal instrument are mostly invisible—we cannot observe the workings of the lungs and throat as we can the fingers of a violinist, the lips of a trombonist, or the hammers striking the strings of a

piano. The manipulation of pitch, volume, and timbre is largely intuitive, a set of skills partly inborn, partly acquired by enculturation, and only occasionally subject to premeditated control on the part of the performer.

As children, we imitate the sounds around us—the honking of car horns, the shrieking of sirens, the mooing of cows, the bleating of sheep, and the voices of our parents, without thinking about how to make such sounds. Speaking and singing share, to a great extent, the unconscious nature of the other functions shared by the vocal organs—breathing, eating, and drinking. Singing teachers in the West have developed a vocabulary for discussing vocal technique, but even the most carefully coached performer of European art songs absorbs a great deal of her art by observing and listening to exemplary singers.

Cultural preferences for particular vocal timbres are, like the entire process of vocalization, essentially intuitive. We learn how a singer's voice should sound by hearing singers, and the preferred timbres of our own musical culture are acquired early and usually taken for granted. The automatic nature of this conditioning is apparent when we hear singing from an unfamiliar culture with aesthetic values different than our own. To a child reared on Italian opera, country and western singing may seem unpleasantly nasal, but to a young fan of country and western music, operatic singing may at first sound mannered and pretentious. Fortunately, such prejudices may be overcome by listening and attempting to understand the aesthetic preferences of less familiar cultures.

Overtone Singing: The Throat-Singers of Tuva

Tuva is a high table-land surrounded by mountains in Central Asia, just over the Russian border from northwest Mongolia. The nomadic herders of Tuva have developed a fascinating vocal style in which the singer sequentially emphasizes different partials of the overtone series, all the while maintaining a steady drone on the fundamental pitch. At any moment, the vocalist is producing two distinct notes, creating a melody out of the changing upper harmonics.

The principle of throat-singing, the selective emphasis of overtones that are always present in the voice, is the same as that of the Jew's harp, which is, significantly, the most popular musical instrument in Tuva. Westerners who are unfamiliar with overtone-singing may have encountered the Jew's harp, which consists of a two-part armature housing a thin piece of metal. The armature is held against the player's upper and lower lips. The player repeatedly plucks the thin metal strip, and by altering the shape of his mouth, changes the overtones which ring along with the



A Tuvan singer maintaining a constant drone on the fundamental while creating a clearly audible melody with the upper partials.

Once you have heard this kind of singing, you may begin to notice the presence of harmonics even in the voices of conventional singers.

fundamental pitch produced by the vibrating metal. A skilled Jew's harpist, like a Tuvan throat-singer, can create clear, rapidly moving melodies by simply adjusting the resonant space in his or her mouth.

According to Ted Levi, Tuvan throat-singing both imitates and interacts with the mountainous, riverine landscape of the Tuvan countryside, and the horse-centered lifestyle of the Tuvan people:

There are kinds of throat-singing that imitate water, that imitate birds, that imitate the growl of a bear, or the cawing of a crow, that imitate the sound of boots rattling in stirrups on a horse. And in addition to these kinds of throat-singing, there are many other forms of music in Tuva that are also imitative in different ways, songs that use the echo of cliffs in a sense to interact with the spirit of the cliff and draw out the echo. Those are also forms of music that, whose inspiration is place, a sense of place.³⁶

Now we will consider vocal timbre in a second genre which draws much of its inspiration from a sense of place: the "ganga" singing of the Bosnian highlands.

Timbre in the Ganga Singing of the Bosnian Highlands

Vocal timbre is affected, not only by the shaping of internal space within a singer's mouth, throat, and chest, but by the external space of the environment in which the individual sings. A singer is greatly influenced by the context of performance, whether it be in a concert hall, living room, or in the mountains outdoors.

Before the breakup of Yugoslavia and the violent destruction of many villages in the Bosnian highlands during the early 1990s, Bosnian villagers, like the nomadic herders of Tuva, tended their livestock in the wide-open spaces of a mountainous terrain. Their vocal style reflects both the broad, outdoor character of the highland landscape and the intimate nature of village society.

The influence of the landscape is perceptible in the sheer volume and penetrating timbre of their singing, a full-throated, somewhat nasal production that seems designed to be audible across valleys and in neighboring hills. The rhythmic nature of ganga—interludes of loud singing alternating with long silences—suggests that space is left for the hills to echo the voices of the singers. The intimacy of Bosnian village society is reflected in the posture of a small ensemble of singing women, standing close and touching one another, so that their powerful individual voices blend into a single resonant whole.

Their choice of intervals—notes spaced only a single scale degree apart—guarantees the presence of “beats,” the acoustical phenomenon of a rapid, regular pulsation which results from the placement of two or more notes in close harmonic “conflict” with one another. The sound waves set up by a single voice create beats when they interact with waves set up by a second voice singing only a whole- or half-step apart, rather like the bobbing caused by the intersection of the wakes of two motorboats passing one another on a body of water.

Ganga singing illustrates the fact that vocal timbre is affected, not only by the space in which the singers perform, but by musical texture—the presence, or absence, of simultaneously sounding voices or instruments. The “beats,” which are an essential part of the timbre of ganga singing, cannot be produced without the presence of at least two voices. Singers, listeners, and even musicologists often confuse the concepts of timbre and texture, in part because the two phenomena are so dependent on one another. The timbre of a single voice is inherently different than that of two or more voices. A difference in *texture*—the addition of one or more voices—results in a difference in *timbre*—the overtone series created by those voices as they interact.

Timbre in Irish and Appalachian Folk Singing

The timbre of singing may be heavily stylized, as in Tuvan throat-singing or Bosnian ganga, or it may be almost conversational, emulating the contours and tone qualities of informal speech. The narrative song traditions of England, Scotland, Ireland, and North America employ a highly conversational style of singing, in which the first priority is given to verbal clarity. The singer’s basic responsibility is to tell a story, in a dialect and accent which can be understood and appreciated by local listeners.

Modern folk-singers often perform traditional ballads on the concert stage, but prior to the mid-twentieth century the setting for a performance of such songs was usually a fairly small room, for an audience of friends and family members. Ballad singers often belonged to the communities in which they sang, and they were not usually paid for performing. Housewives, farmers, and other local people provided their own, home-made entertainment before the days of television, commercial recordings, and radio broadcasts. Singing reinforced a sense of local identity for both singer and listeners, who might also take a turn at singing in the course of an evening’s fun. In such a setting, with no need to project the voice across a valley, or to the last row in a large concert hall, the singer could give maximum attention to telling the story. This emphasis on storytelling did



Bosnian ethnomusicologist Mirjana Laušević singing a ganga entitled “Sjajna Zvezdo” with Donna Lee Kwon and Tristra Newyear, members of the ensemble known as Zabe-i-Babe.



In this example, Joe Heaney sings the English language song “The Rocks of Bawn” in the sean-nós style. His distinctive tone quality has provided an influential example for an entire generation of sean-nós singers in contemporary Ireland.



Compare the timbre of Joe Heaney's voice to that of Irish vocalist Pat Kilbride, in his rendition of "The Flower of Magheralee."



John Cohen sings the American ballad "Pretty Polly." John Cohen's pronunciation, and resultant tonal quality, is strongly influenced by the voices of ballad singers from the southern Appalachian Mountains, and it is tempting to believe that the timbre of the entire tradition is colored by the predominantly treble qualities of the banjo and fiddle, the two most common traditional instruments in the region.

not encourage the display of exaggerated histrionics, however, understatement was an important aesthetic value.

In these narrative traditions, then, singing closely reflects the sound of everyday speech. Remembering that vocal timbre is a result of the formation of vowels and singable consonants, it is clear that tone quality is dependent on pronunciation, and that dialect and accent must therefore be central in determining a community's preferences for particular kinds of tone color. The timbre of North American, Irish, Scottish, and English folk singing reflects the hundreds of local accents of particular communities and singers in a network of inter-related music cultures.

The singers of Connemara, in western Ireland, developed a particularly interesting singing style in which vocal timbre plays a distinctive role. The most famous exponent of this style, known in Irish Gaelic as *sean-nós* ("old-style") singing, was Joseph Heaney. Sean-nós singers perform primarily in the Irish language, in a style which emphasizes the use of delicate melodic ornamentation and, in many cases, a strong nasal vocal timbre.

The deep, reedy quality of Joe Heaney's singing has come to exemplify the Connemara sean-nós tradition to many modern listeners, but we should remember that each singer is an individual, and that each person's vocal timbre, while it reflects aesthetic preferences of the culture in which he lives, is also as personal as a signature or fingerprint.

Many narrative songs from Ireland, Scotland, and England traveled with immigrants from those nations to the Appalachian Mountains of the United States, where they fed new song traditions, eventually adding a southern American "twang" to the singing timbre.

Western Classical Singing

Timbre is perhaps the central concern in the training of Western classical singers. Performers of European art song have adopted the term *chiar-oscuro* (clear-dark) from the vocabulary of art history, to describe the ideal round and rich timbre of a classically-trained vocalist.

If we compare the singing of an opera singer with that of a balladeer from the Appalachian Mountains, we notice some striking contrasts. The opera singer must be able to sing loud enough to be heard in a large hall over a full orchestra and chorus; the balladeer needs only enough volume to be heard by a small audience in a living room or kitchen. The opera singer strives to blend both "bright" and "dark" timbres in each note; the balladeer tends to emphasize primarily the bright side of the tonal spectrum. The opera singer performs with a wide, cultivated vibrato, a

minute fluctuation of both volume and pitch in every sustained note; the balladeer's voice may or may not include vibrato, but it usually is not consciously cultivated.

Classical singers are divided into four basic voice types, based primarily on their natural pitch range. Men with low voices sing bass, men with high voices sing tenor, women with low voices sing alto, and women with high voices sing soprano. Within these categories, there are sub-groups based on features such as timbre, range, flexibility, and stylistic approach. The "dramatic soprano," for example, tends to have a darker voice and more declamatory style; the "lyric soprano" has a lighter voice and a more easygoing style of production, and the "coloratura soprano" has a very high voice with remarkable speed and flexibility.

All singing is stylized, removed to some extent from the conversational quality of everyday speech. If the Appalachian balladeer represents the informal end of the stylistic spectrum, then the opera singer must represent the formal end, in which stylization removes pronunciation and timbre far from the realm of natural speech. This does not mean that the balladeer's performance is unstudied. On the contrary, the folk-singer must work to realize the aesthetic values of his genre, just as the lyric soprano works to create a beautiful performance within the parameters of Western art song.

The large, robust sound and strong vibrato of the contemporary opera singer are not desirable in every performing context of Western classical music. Singers who specialize in early music, from the Baroque and especially from the Renaissance eras, often perform with small ensembles or the accompaniment of a single, quiet instrument such as the lute or guitar. A loud, operatic style, replete with a wide vibrato, would sound overbearing in such a musical context, so early music specialists tend to cultivate a quieter style, in which vocal flexibility and precise intonation are more important than volume.

The volume and vibrato required of an operatic soloist are also considered inappropriate in the context of choral singing, where the primary consideration is the ability of the vocalists to blend their voices in a well-coordinated ensemble. Like the orchestra, choral singers united together to create a composite sound in which no single voice stands out.

Finally, we should remember that, although Western classical singers tend to strive for an ideal blend of "light" and "dark" timbres in their singing, each singer is an individual. The aim of classical vocal pedagogy is not to produce thousands of singers who each sound the same, but to allow each singer to develop his or her unique voice within the accepted

parameters of the tradition. In this respect, the widely variant timbres of Tuvan throat-singing, Bosnian ganga, Appalachian balladry, and Italian opera represent a variety of solutions to a single problem—that of giving voice to artistic inspiration within the aesthetic values of a given peoples' culture and history.

SUMMARY

In describing the experience of hearing music, we often employ visual metaphors. “Tone color” is the most common way of describing the element of music known as timbre. Physically, sounds do not have “color,” but each voice and instrument has a distinctive tonal quality based on the combination of overtones it generates. Timbre is perhaps the most personal aspect of music; no two singers or instruments sound alike, in part because of the unique overtone “signature” of every sounding body.

Composers use a broad “palette” of timbres to create particular effects, just as painters use color. Every culture has its own set of timbral preferences; the desired buzzing quality of an Indian sitar is very different than the crisp, clear sonority of a guitar or mandolin.

The human exploration of sound is a continually evolving process. Musicians and audiences are constantly defining and redefining the sounds which we call music. While some musical instruments seem to have remained fairly stable over hundreds of years, others have changed dramatically. The remarkable invention and dissemination of the steel band in Trinidad during the last fifty years demonstrates how quickly musical traditions can be transformed.

With the invention of electronic instruments and computers in the twentieth century, our capabilities for producing, reproducing, and storing sounds have completely changed. Recording technology was developed by the late 1890s and electronic instruments were already developed in the 1920s and 1930s, including the electric guitar that was on the market by 1936. Recordings, radio, television, electric instruments, and computers have altered how and where we compose, record, alter, and listen to music. It has also generated a vast realm of new timbral possibilities. This relationship between music and electronic technology will be discussed in detail in Chapter 12.

ADDITIONAL LISTENING

AUDIO #33 BASSAM SABA PLAYS A TAQASIM ON THE ARABIC NAY

Bassam Saba slowly explores the third and fourth degrees of the scale, exhibiting the unique double-octave sound characteristic of traditional nay performance. He achieves a timbre that includes one and the same note in two different octaves at the same time. The tone colors range from a fairly pure sound—especially in the high register—to the breathy or airy sounds that often result when the musician breaks between high and low octaves.

POINTS TO REMEMBER

1. Timbre, like pitch and rhythm, is one of the fundamental elements of music. Timbre refers to its tonal quality or color.
2. Every sound has a distinctive timbre because of the acoustical phenomenon of the overtone series.
3. Different cultures have distinct aesthetic preferences for particular sound qualities; timbre is related to tradition, technique, and structure, as well as to individual expertise and sensitivity.
4. A vibrating sound source can be produced in a finite number of ways; stretched strings may be plucked, struck, or set in motion by a bow; air may be forced through a tube at a higher pressure than the air outside causing the tube to vibrate; a stretched skin may be hit, rubbed, or scraped; a solid object may be shaken, hit, scraped, rubbed, or whirled, and finally, the sound may be produced electronically.

POINTS FOR DISCUSSION

1. Why does every sound have a distinctive timbre?
2. What factors besides the overtone series affect the timbre of an instrument?
3. How is timbre related to tradition, technique, and structure, as well as to individual expertise and sensitivity?
4. What are the ways in which a musical sound can be produced? Give examples.
5. How are instruments classified in the Sachs-Hornbostel system? Give examples for each category.

STUDY QUESTIONS

1. What gives each sound its own distinctive timbre?
2. What three things are necessary in order to produce a sound?
3. What are the five categories of instruments in the Sachs-Hornbostel system?
4. What are the major sections in the contemporary symphony orchestra?
5. What are some of the timbral qualities of the North Indian sitar that give it a different sound than the guitar?
6. What timbres are valued in the performance of the Japanese shakuhachi?
7. What factors affect the production of vocal timbre?

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