



## How the ear works and... how sound becomes music



**Atlanta  
Symphony**  
Orchestra

**Joseph Young**, Conductor

**Our world is full of sound.** On any given day, we hear laughter, conversation, car horns, birdsongs, and wind rustling through trees — and we hardly even notice. Our ears process the sounds that our brains recognize as objects or events.

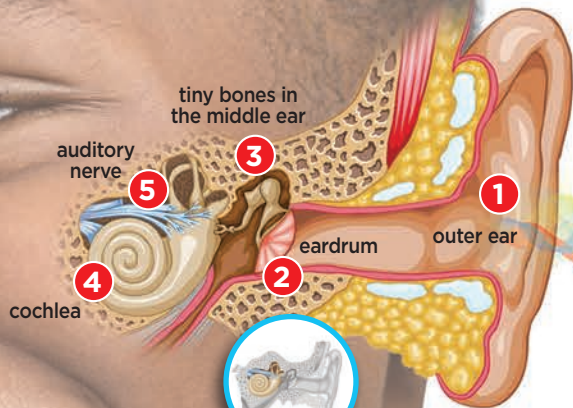
Music, however, is art that we “see” with our ears. We process music differently than the sounds of everyday life. Music makes us smile, makes us dance, gives us energy, and touches our hearts. How is our hearing able to make us feel all those things?





# The Ears: Out

The ears are extraordinary organs. While our sense of taste, smell, and sight is based on chemical reactions, the ability to hear is purely mechanical.



INNER EAR



MIDDLE EAR



OUTER EAR

1. Sound waves enter your **outer ear** and travel through the **ear canal** to your eardrum.
2. The **eardrum** vibrates and sends the vibrations to **three tiny bones in your middle ear**.
3. The bones in your middle ear make the sounds louder and push them to the inner ear, or **cochlea**.
4. Inside the cochlea, the fluid vibrates a series of tiny hairs called cilia, which are attached to **auditory nerves**.
5. Your auditory nerve carries the sound to the brain which turns it into the sounds we hear.

## Listen up!

The ear has three basic parts, the outer ear, the middle ear, and the inner ear.

The outer ear, the part you see, is able to place the location of a sound, whether it's above, ahead, behind, or below and to the left or right. It also draws sound waves to the middle ear, which contains a canal that leads to the eardrum.

The inner ear sits on the other side of the eardrum and contains the cochlea which converts sound vibrations into electrical impulses that are sent to the brain.

## Sound off!

Sound is created by vibrations that travel through the air until they reach our ears and the brain interprets them as specific sounds. Those same vibrations can be felt through other parts of the body. Have you ever felt a cellphone vibrating in your pocket? Have you ever felt a car with booming speakers as it passes by in traffic?

When an object vibrates in the air, it moves the air particles around it — which, in turn, move air particles around them, and onward and so on — so that the vibration continues to travel through the atmosphere.

When a bell is rung, the vibration causes the metal to actually flex in and out, ever so slightly. The outward flex nudges air particles to bump into other particles, and so on. The inward flex tugs on air particles and creates a pressure drop that pulls on more particles.

In this manner, a simple vibration creates "waves" of sound.

The difference in the sound created by different objects depends on the quality and frequency of those vibrations. A higher wave frequency — when air particles are *more* agitated — results in a higher pitch. A lower wave frequency — when air particles are *less* agitated — results in a lower pitch.

The loudness or volume of the sound is a separate matter.

Loudness is determined by the amount of pressure packed behind the vibration that triggered the sound. If you barely tap a bell, you get a tiny sound. If you clang a bell, you get a louder sound.



# side-in & Inside-out

## Bang a drum!

The eardrum is the most important part of the ear. In fact, the whole ear functions to pass along information gathered at the eardrum.

The eardrum is a thin and tiny piece of skin, shaped like a cone. Sound waves travel to the end of the ear canal and vibrate against the eardrum. The eardrum absorbs these vibrations and delivers them to the inner ear. At the same time, the eardrum protects the inner ear from the possibility of being injured by loud, low-pitch noises.

The eardrum is powerful but it's fragile too! Most doctors warn against poking anything into your ear — not a crayon or a pencil, not even a Q-tip — because of the risks involved in poking or puncturing your eardrum.

On the opposite side of the eardrum, the cochlea in the inner ear receives the vibrations in the sound waves and translates them into electrical information that the brain recognizes as sounds. How do vibrations turn into electrical data? That's still a mystery — but researchers learn more about the nature of our ability to hear every year.



## Catch a wave!

To hear a sound, the outer ear first “catches” sound waves and draws them into the hearing part of the ear. The middle ear then senses the shifting changes in the vibrations. The inner ear converts the vibrations into electrical signals that the brain can understand.

The brain figures out the position of a sound by comparing information coming from both ears. If the sound comes from the left, it arrives at the left ear sooner — and louder — than it would at the right. Human ears are flat and face forward so we hear sounds in front of us better than we hear sounds behind. Dogs, elephants, and other mammals have large, movable ears so that they pick up sounds from many directions. When humans cup hands behind our ears, we are simply creating a bigger catcher's mitt for sound.

## The Many Sounds of Music



**M**usic contains all kinds of sounds. **PITCH** refers to the high notes, low notes and all the notes in between. **RHYTHM** describes the pattern of long and short notes. When pitch and rhythm are combined, they create a **MELODY**. **TEMPO** means whether the melody is fast or slow and **VOLUME** means whether it's loud or quiet. **MUSICAL DYNAMICS** refers to all the changing factors we hear. Music can be soaring and romantic

— or harsh and dramatic — or any number of things. It all depends on the composer, the conductor, the instruments and the musicians.

The orchestra is a large group of musicians who play together at once. Typically, an orchestra is divided into four sections: woodwinds, strings, brass, and percussion. The woodwinds section features clarinets, saxophones, and flutes. The string section contains violins, violas, cellos, and

basses. The brass section has the trumpets, horns, trombones and tubas. The percussion includes drums, cymbals, and chimes. In performance, the four sections of the orchestra play together as one.

The conductor is the man or woman who stands on a podium at the front of the orchestra and guides the performance of music by marking the tempo and shaping the dynamics, either with hands or a baton.





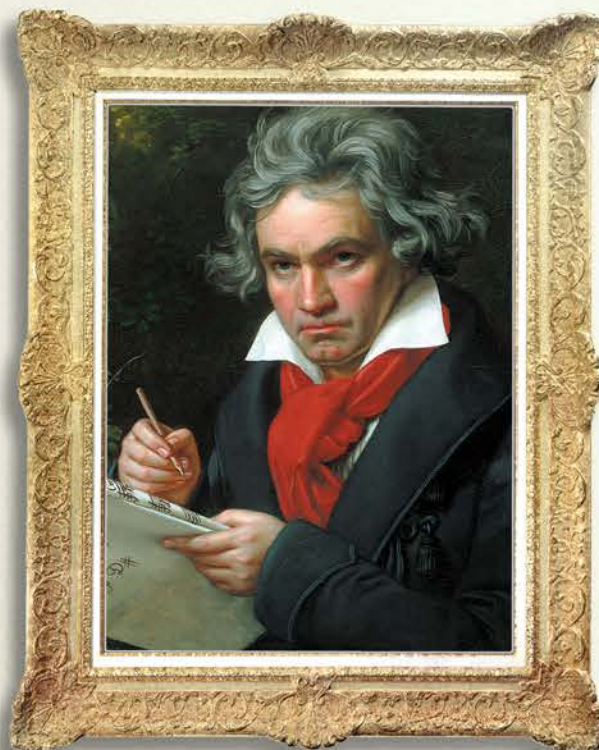
# Beethoven: The Bad-

**Ludwig van Beethoven (1770-1827)** established himself as the greatest composer of his own lifetime. Today, he is acknowledged as a giant among all the composers that ever existed. Shortly after he was born in a small city in Germany, Beethoven's father decided that he should be a great musician. Little Ludwig started piano lessons while he was still so short that he stood on the bench to reach the keys! Beethoven pushed himself as much as his father would push him, practicing through the night and into the morning. His first public piano performance occurred when he was only 10 years old. At 11, he quit school to pursue music full-time. At 14, he was hired as an organist for the royal court - and his reputation only increased from there. He sought out the greatest composers of his day so that he could learn from the very best. As a composer, Beethoven kept detailed notebooks and repeatedly reviewed his own work until it was "perfect" for publication. Beethoven was determined to understand music inside and out.

## A Man of the People

The people adored Beethoven, even though he was often moody and bad-tempered in person. His enormous popularity is due to his glorious music and to Beethoven's sense of himself as "a man of the people" at a time when political revolutions in France and America were also asserting the power of people. Beethoven did not write polite, elegant music to entertain kings and queens. He wrote big, passionate, emotional "music for the ages" that made people sit up and listen - and they liked what they heard. City governments built civic concert halls and hosted municipal orchestras to meet the public demand to hear Beethoven's music.

Beethoven himself responded to the popular demand by increasing the size of the orchestra to make a bigger sound. He added the piccolo and the contra-bassoon to the orchestra to play notes that were both higher and lower than had been heard before. He experimented with "program music," using music to paint pictures of settings or events, like peaceful country picnics or turbulent battles at sea. He also changed the relationship between the orchestra and "special guest" musicians, such as pianists and singers, so that audiences never knew what to expect next. Under his influence, a new Beethoven symphony became a performance event.



Beethoven's musical scores were typically sloppy and covered with his own corrections. Here is a sample from his handwritten drafts of a symphony.





# Tempered German Giant

## Beethoven's Fifth Symphony:

### LISTEN For...

Beethoven wrote all kinds of musical forms but his symphonies are what really secured his reputation as a composer. A symphony is a large-scale orchestral work performed in three or four smaller sections, known as "movements." Beethoven's Fifth Symphony is probably the most famous symphony of *all time*. Beethoven commands the audience to listen with a simple yet landmark opening motif of four notes. A motif is a short rhythmic or melodic phrase that is repeated in a composition.

Listen to the opening of Beethoven's Fifth Symphony for the trademark motif. Try playing "Rock, Paper, Scissors" in time with the beat — counting 1-2-3 on the short notes and delivering either rock, paper or scissors on the long note.

Beethoven repeats that motif throughout his Fifth Symphony. It seems to command the audience's attention. It demands to be heard. Scholars have suggested that Beethoven's famous motif is asking a philosophical question about the meaning of life or the existence of God.



*The musical score for that famous musical motif from the Fifth Symphony.*



## And He Was Deaf

Early in his career, when he was only 27 years old, Beethoven noticed that he was unable to hear high notes. Over the next 20 years, Beethoven slowly became totally deaf. No one knows for certain what caused Beethoven's deafness, although it was probably due to several different health conditions.

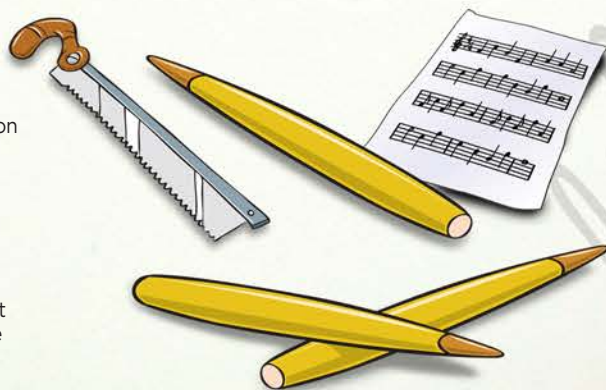
In Beethoven's day, society was extremely uncomfortable with disabilities and judged them harshly. In response to those attitudes, Beethoven wrote many letters to his brothers sharing his anger, resentment and despair at the prospect of becoming deaf. During his career, he used "ear trumpets" and handwritten "conversation books" to communicate despite his deafness. During this same period when he was increasingly turning deaf, Beethoven also wrote some of the most incredible music the world has ever heard. In truth, Beethoven's deafness affected his social life more than his music. He became increasingly isolated from family and friends but he never stopped writing music.

It is important to note that Beethoven's music is remarkable all by itself — in the same way that Shakespeare, Michelangelo and Picasso are remarkable. Beethoven's deafness doesn't make his great work "greater" — but it does say something about the incredible dedication he applied to his life's work.

## How could Beethoven "hear" music — when he couldn't hear?

Beethoven had already mastered writing music when he became aware that he was becoming deaf. In the same way that a construction worker can look at blue-prints and see the whole building project, Beethoven could look at a musical score and "hear" the musicians performing "inside his head," using his imagination.

Even without his imagination, Beethoven could "feel" the music with his senses — because sound *vibrates*. Beethoven might not have heard the music but he could feel the vibrations. He famously sawed the legs off his piano and placed the instrument flat on the floor. That way, Beethoven could feel vibrations of the piano strings through the wooden floor as he played.





# Composers Who Rock



**Felix Mendelssohn (1809-1847)** was a German composer of the early Romantic period in music, although "romantic" doesn't refer to valentines so much as the use of music to express big emotions and big ideas. Mendelssohn is considered to have been the greatest child prodigy since Wolfgang Amadeus Mozart. A "prodigy" is someone who shows exceptional gifts that seem to be beyond their age or experience. Mendelssohn started piano lessons when he was 6 and made his first public recital in Berlin at age 9. He also started composing music while he was still young, and finished five short operas and eleven symphonies during his early teens.

As a young adult, Mendelssohn had already established himself as a great composer of symphonies, concertos, oratorios, piano music and chamber music. He was only 17 when he wrote one of his best known works, an overture based on Shakespeare's *A Midsummer Night's Dream*. Twelve years later, he composed additional incidental music for *Midsummer*, including the Scherzo.

## Mendelssohn's Scherzo from "A Midsummer Night's Dream":

### LISTEN For...

The term *scherzo* describes a shorter section of a large orchestral work that is light, playful, and amusing in tone. Mendelssohn wrote a scherzo as an instrumental interlude to play during a performance of Shakespeare's *Midsummer*. The story concerns a wedding that takes place next to a magical forest inhabited by mythical fairies. Oberon is the powerful king of the fairies and he makes his entrance during the *scherzo*. Mendelssohn uses music here to suggest the chatter of fairies, fluttering between the trees. He also offers a regal march to accompany the entrance of the fairy king.

### ASK yourself...

What instruments did Mendelssohn choose to "paint" the picture of this magical forest? Why does the music sound like the wind? Or like the chatter of fairies? How does Mendelssohn signal that a king has arrived on the scene? Does he introduce new instruments into the composition to make it sound like a royal march? What pictures does the music suggest? What emotions might be triggered by this music?



**Béla Bartók (1881-1945)** was a Hungarian composer who made a huge impression on music during the 20th century. He was born in a small town in Hungary and displayed early talent. By the age of four, he could play 40 pieces on the piano. He gave his first public recital at age 11. Bartók was raised in Hungary at a time when people were very conscious of their ethnic roots. His own father considered himself thoroughly Hungarian while his mother was of "mixed Hungarian" because many of her ancestors came from surrounding countries. People took great pride in the folk music that came from their own culture.

As a young man, Bartók traveled into the countryside to collect and research folk melodies from all the different people who lived in Hungary. He discovered that the old folk melodies were based on scales and tonalities that could also be found in the folk traditions of Central Asia and Siberia. Bartók was fascinated by the music that surfaced from these folk traditions - and he wanted to elevate it into the form of classical music.

Bartók decided to base his compositions on Hungarian traditions by weaving folk harmonies into his music or by quoting folk songs directly. When he set these melodies into classical works performed by orchestras, Bartók made sure that the folk music of his people would live forever.



## Bartók's Romanian Folk Dances:

### LISTEN For...

Bartók's travels introduced him to seven Romanian tunes that had originally been played on the fiddle or a wooden flute in Transylvania. He adapted these songs into an orchestral work called "Romanian Folk Dances" - but the melodies don't necessarily sound like dance music today. The selections have short titles that translate to "Stick Dance" or "Sash Dance" and were performed as the evening's entertainment in small villages.

Townspeople would gather to listen to fiddlers play these melodies while they danced and shared food or conversation. The bittersweet quality of the melodies is neither happy nor sad but was likely to make the people revisit fond memories and to reflect on their lives and loved ones.

### ASK yourself...

As you listen to Bartók's Romanian Folk Dances, ask yourself how the violin is able to "sing" in a manner that sounds like the human voice. You might not have grown up in a small country village, but these melodies are still capable of conjuring memories. What do they make you think about as you listen? Do they paint pictures in your imagination? Do they tell stories?



# the World of Sound

## Tchaikovsky: The Russian Romantic

**Peter Ilyich Tchaikovsky (1840-1893)** was the first Russian composer to achieve world-wide acclaim. He remains popular today for his symphonies, concertos, operas, ballets, chamber music and choral works. If you have ever attended *The Nutcracker* ballet, you are already familiar with the music of Tchaikovsky.

He was born in a small town and studied music as a child. His family did not encourage his talents, however, because few opportunities existed for professional musicians in Russia at the time. At the age of 22, he enrolled himself in the Saint Petersburg Conservatory to study music composition, although he held onto a more stable civil service job. His conservatory experience gave Tchaikovsky the skills to become a professional composer.

Tchaikovsky made a name for himself by boldly composing works that combined Russian melodies and harmonies with the rich, lush, romantic sound found in Western European music. At first, Russian critics accused Tchaikovsky of disrespecting their national identity — but audiences embraced his work and eventually the critics were won over as well.



### LISTEN for...

The 3rd movement of Tchaikovsky's 4th Symphony is intended to be playful and amusing — but with an orchestra, nothing playful is going to be slight or “tossed off.” The work actually places dazzling technical demands on musicians and calls for extreme focus and concentration.

Tchaikovsky features the string section in the opening of his scherzo but the violinists are not playing the strings with their bows. Instead, the musicians are plucking the strings with their fingers for a light, brisk effect known as *pizzicato*. After the opening, the melody is handed off to interesting pairings among the woodwinds section, including the piccolos, oboes and clarinets.

### ASK yourself...

As you listen, ask yourself how Tchaikovsky composed music to make it amusing. Does it have to do with the tempo? Is it the rhythm? Is it in the pitches — the high notes and low notes? Or maybe it has to do with the “voice” of the instruments. What makes this *scherzo* so entertaining?



## Kurth: A New Work from an American

**Michael Kurth (1971 -)** is an American composer who has also been a member of the ASO bass section since 1994. His new work, titled “Prometheus Unhinged”, is his third ASO commission, following the world premieres of “May Cause Dizziness” in 2011 and “Everything Lasts Forever” in 2013.

Kurth serves as Composer-in-Residence for the Riverside Chamber Players of Roswell, where he has written five commissioned works. In 2013, the Riverside Chamber Players released a CD of Kurth's string quartets. He has also written two commissioned works for the Atlanta Chamber Players.

Kurth's work has been performed by The Atlanta Young Singers, The Peachtree String Quartet, The Franklin Pond Quartet, Concert Artists Guild-award-winning violist Jennifer Stumm, The Georgia Sinfonia, The Atlanta Community Symphony Orchestra, The Georgia State University Wind Ensemble, and Modern Dance Company gloATL.

He began playing bass at age eight and later received his bachelor's degree with honors at Peabody Conservatory in Baltimore, MD. Before joining the ASO, he was a member of the New World Symphony in Miami Beach, FL.



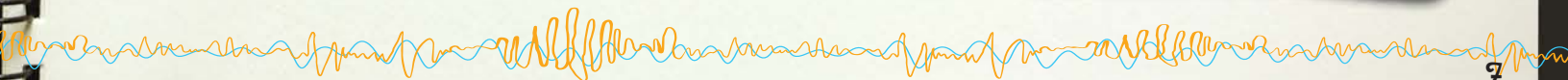
## Words to Know

A **scherzo** is a section of a longer musical composition that is usually light, humorous and amusing in tone. The term comes from the Italian language for “to joke.”

**Pizzicato** is a playing technique used on stringed instruments to create short, quick, brisk bursts of sounds. On most instruments, the effect is created by plucking the strings with fingers. The term comes from the Italian language for “to pinch.”

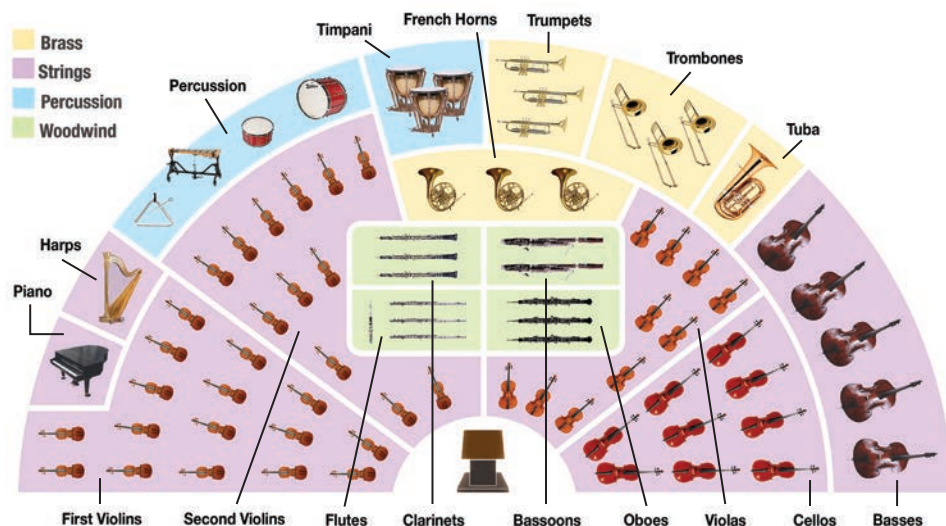
**Staccato** is a playing technique used on all sorts of instruments to create short sounds separated by an element of quiet. The term comes from the Italian language for “to detach.”

**Virtuoso** is a word used to describe an individual with superior technical ability in playing a musical instrument or a particular composition. The term comes from the Italian language for “virtuous.”



# Meet the orchestra – and how it creates sound!

An orchestra is comprised of four sections, representing four different types of instruments.



## Here comes the brass!

The brass section contains horns, trumpets, trombones, and a tuba. Brass instruments deliver the loud, exciting parts of the music. They are also used to create epic swells and sudden bursts of sound.

The sound comes from the musician's lips. The player places his or her lips tightly against the mouthpiece and blows a blast of air, sending a vibration down the tube of the instrument. Musicians can vary pitch, tone, and loudness by controlling the vibration of their lips. (It takes practice!)

The valves are the buttons on brass instruments. Valves or slides on brass instruments allow the player to change the length of the tube and create different sounds and notes. The tube is called the bore and the part that flares out wide at the end is called the bell. The shape and size of the bore and the bell can change the tone of the instrument. For example, the shorter length and smaller bell on a trumpet creates a crisp, blaring tone. A French Horn, with its longer bore and larger bell, has a warm, mellow tone.

## Bring in the strings!

The string section includes violins, violas, cellos, and double basses. The sound of these instruments ranges from soft and sweet — to harsh and severe — to soaring and majestic.

The sound of stringed instruments is caused by the vibrations of the strings. A player rubs a bow against the strings, or strums or plucks them with his or her fingers. The player controls the pitch of the sound by making the strings longer or shorter — and tighter or looser. (Shorter and tighter strings create higher pitches. Longer and looser strings create lower pitches.)

## We got the beat!

The percussion section holds the drums, chimes, gongs, cymbals, and whistles. These instruments provide pounding rhythms, booming drum rolls, and driving energy.

The sound is produced by one object hitting another, which is what the word "percussion" means. Percussion instruments are either "tuned" or "untuned." Tuned instruments, such as the xylophones, chimes, or the timpani, play specific pitches or notes. Untuned instruments, such as most drums, cymbals, the gong, and the triangle, produce sounds with an indefinite pitch.

Drums come in many shapes and sizes but in each, a membrane is stretched across a frame or hollow container. When the membrane is struck with a stick or mallet, it sends vibrations echoing within the container. Every country in the world has its own version of the drum.

## And now for the woodwinds!

The woodwind section is home to flutes, oboes, clarinets, and bassoons. Woodwinds can carry the melody over the quietest and the loudest parts of a musical work. Some think they come closest to the quality of the human singing voice.

The sound comes from blowing air into or across the mouthpiece. In the flute family of instruments, air is blown across an edge, like blowing across the mouth of a bottle. The air is split by the edge, resulting in vibrations. In reed instruments, the air travels across of thin piece of wood, called a reed. Clarinets and saxophones have one reed. Oboes and bassoons have two reeds that vibrate against each other.

The manner of creating the sound may vary between the flute and the reed instruments but the manner of controlling the tone remains the same. Woodwind players cover holes on the long tubes of woodwind instruments. Sometimes the holes are covered by fingers. On longer instruments, the musician presses a metal key that raises a soft pad that had been covering a hole.



**Atlanta  
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