

Woodson Art Museum

in your classroom

Medieval to Metal: The Art & Evolution of the Guitar

Spring 2015



Top: Chrissie Hynde of The Pretenders, 1980, photo by Neil Zlozower; *Stratocaster*, 1954, design by Leo Fender, Freddie Tavares, et al., manufactured by Fender Musical Instruments; Guitars lineup, left to right: *Baroque Guitar*, ca. 1600, unknown designer – originally from Iberia, commissioned reproduction; *Goldklang Parlour Guitar*, ca. 1890, unknown designer, manufactured by Frederick & Reinhard Enders; *Telecaster*, 1949, design by Leo Fender, manufactured by Fender Musical Instruments; *B.C. Rich Warlock Red*, 2001, design by Bernardo Rico, manufactured by B.C. Rich; Bottom: *Gibson Les Paul*, 1952, design by Ted McCarty, et al., manufactured by Gibson. (Recording model features design elements by Les Paul); Chuck Berry, 1973, photo by Neil Zlozower

Introduction

This spring, *Medieval to Metal: The Art & Evolution of the Guitar* takes center stage at the Woodson Art Museum through May 31, 2015. The exhibition, organized by The National Guitar Museum, features forty instruments ranging from early precursors to the guitar, such as the *oud* dating back to 3000 BC, up to the Italian-made, minimalist, gold leaf Di Donato guitar. *Medieval to Metal* also includes twenty-two black-and-white photographs by legendary rock photographer Neil Zlozower, of American music greats B.B. King, Les Paul, Chuck Berry, Eddie Van Halen, and more. Eleven life-size illustrations by artist Gerard Huerta also are on view, featuring guitars, drawn in pencil by and then digitally colored to replicate the instruments in pristine condition.

Medieval to Metal demonstrates that when it comes to guitars, beauty is in the eye of the beholder and the ear of the player. What draws a musician to his or her instrument of choice is up for debate. Whether it's an electric guitar marketing battle between Gibson and Fender; the use of a coveted, rare wood on an acoustic guitar; or the recognition of a famous musician, whose name appears on the headstock, not unlike a recipe's cherished secret ingredient, dedicated guitar players attribute the quality and success of an instrument to many details and reasons.

We invite you to explore *Medieval to Metal* and these materials to learn more about the artistic and acoustic evolution of the world's most popular instrument.

Guitar Origins

* *Pre-visit educational materials and resources developed utilizing The National Guitar Museum's education guide materials.*

The guitar is the single most enduring music instrument icon in American history. There are more guitars made every year than all other instruments combined; with approximately 3 million guitars are sold annually in the United States.



Oud, origin: 3000 BC, design unknown, luthier unknown



Di Donato, 2012, design by Edoardo & Enrico Di Donato, manufactured by Di Donato Guitars

The transformation of the guitar's materials, shape, sound, and aesthetics makes for a colorful and dynamic history. The guitar evolved from European and Asian instruments during the Middle Ages; these include the *oud*, *vihuela*, and *lute*. For hundreds of years, guitar makers have experimented with dozens of different shapes and structural elements, seeking the perfect blend of beauty, physics, and sound. The traditional bowl-shaped base of

the *oud* and *lute* transformed to become ergonomic and the curves of today's acoustic guitar.

European luthiers who emigrated to the United States changed the guitar's structure to make it louder and sturdier. Strings may vibrate, but strings by themselves don't make much noise. The soundboard of an acoustic guitar, not its body, enhances the strings' vibrations and those vibrations project out to the listener.

The guitar was the first multi-faceted instrument that allowed singers and performers to accompany themselves, and the guitar was easy to travel with. The traveling guitar gave rise in the early 1900s to the blues in the Deep South and country western music in the expanding United States. Technicians, luthiers, and musicians attempted to make guitars louder for band members who couldn't hear their guitars above drummers and horn players. They began using electricity in the 1930s to amplify guitars. Visitors will see how, instead of using a large hollow sound box, the electric guitar uses magnetic coils to capture the vibration of the strings and turn it into amplified sound, making the guitar one of the loudest musical devices.

Wide-scale production of the electric guitar started in the 1950s and has continued unceasingly to the present. Inventors and designers like Leo Fender, George Beauchamp, and Les Paul came up with new innovations and body shapes that also changed the shape of music.

By the 1960s, the guitar had evolved to become every bit as important to social change as newspaper editorials and politicians' speeches. Street corner guitarists led anti-war protest movements while angry youths fighting against the status quo took up guitars to fuel their punk instincts. The guitars of this era got wilder by design, employing materials like plastic, carbon fiber, and even metal that led to more radical shapes and sounds.



Left: *CraViola*, 1969, design by Paulinho Nogueira, manufactured by Giannini;
Right: *Apollo Greenburst*, 1969, design by Teisco, manufactured by Teisco/Kimberly

Chordophones

Guitars belong to a group of instruments known as *chordophones*. These are instruments that make sound using a string — or many strings — stretched between two points. The pulling, plucking, strumming, bowing, or hammering of the string causes a vibration that generates sound waves. The greater the string tension, the higher the pitch of the sound. Chordophones usually

have a resonator, or soundbox, that helps amplify and project the sound that is made when the strings vibrate.

Examples of chordophones include: guitars, banjos, lutes, violins, cellos, harps, and pianos. Even though it sounds like a chordophone should be used to play *chords* — groups of notes played together — the name has nothing to do with playing chords. All chordophones can play single notes.

History

Throughout the Renaissance (from the late 1300s to the early 1600s), the lute was the preferred stringed instrument of European musicians. Many players sought to customize their lutes by adding more strings and lengthening the neck, allowing a wider range and combination of notes to be played. Many of these modifications became so popular that they served as the basis for brand new instruments. Yet, so much modification resulted in the creation of a huge variety of instruments that took on their own characteristics. Many of them were precursors to the guitar, although no single one led to the guitar as we know it today.

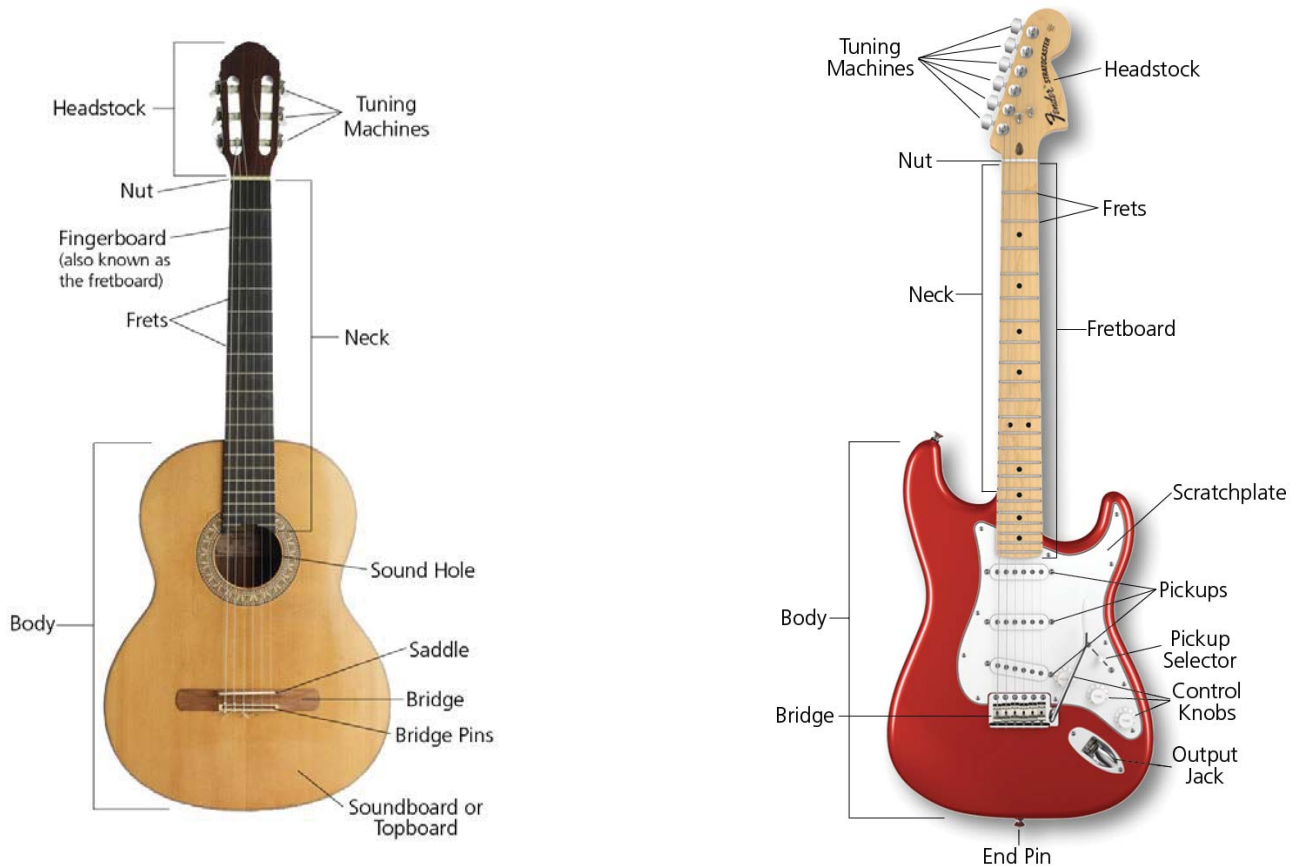


Michelangelo Merisi da Caravaggio, *The Lute Player*, c. 1596, oil on canvas
Note the 14-stringed lute the young boy is playing.

The word “guitar” has a jumbled origin derived from a multitude of sources: *kithara* (Greek), *cithara* (Latin), *qitar* (Arabic), *gittern* (English), *gitarre* (German), *guitare* (French), *chitarra* (Italian) and *guitarra* (Spanish) . . . these are all names from antiquity that contributed to the creation of the word “guitar.” It seemed as if every conceivable spelling of guitar was used prior to the 1800s, when the current English spelling was adopted.

The Essential Elements

The guitar is made up of a number of different pieces. On acoustic guitars, these pieces are made primarily of wood, whereas electric guitars have a body of wood with lots of metal and plastic parts, too.



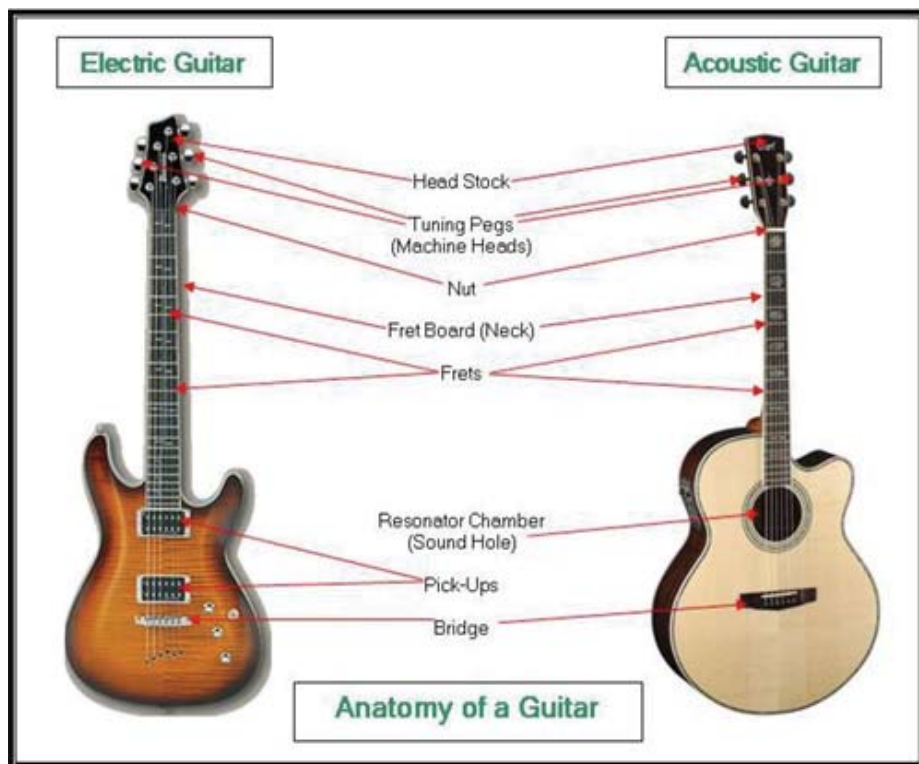
Body

The biggest part of the guitar is the body. It has a top (or face), a back, and sides. The top of an **acoustic guitar** is designed to project the sound caused by the vibration of the strings. The front, the back, and the sides are often made of different types of wood.

The body of an **electric guitar** is usually a block of solid wood. It creates sound using electromagnetic pickups that capture the vibrations of the strings.

Neck

The neck is the part of the guitar that extends out from the body. Strings are attached to the end of the neck (called the headstock) and run all the way down to the body. The neck is the part of the guitar where notes are formed by pressing strings against the part of the neck called the fretboard.



Strings

The most important part of a guitar is the strings. Every guitar has six strings as a standard setup, although some have more, even as many as 12 strings. Strings can be made from metal, plastic, or catgut, depending on the kind of guitar they're attached to and the music being played.

Fret

A fret is a narrow piece of wire that is inserted into the fret board. When a string is pressed against the fret, the vibrating length of the string is shortened. Each fret produces a different note by shortening the string's length a certain amount.

Tuning Pegs

Tuning pegs hold the strings in place at the top of the neck. They can be turned so that each string can be tightened or loosened to achieve a desired pitch. Tuning pegs are also called tuning heads, tuners, machine heads, and pegs. The part of the neck they are attached to is called the head stock.

Bridge

The bridge holds the strings to the body of the guitar.

Materials and Construction

The primary "ingredient" in guitars is wood. Some woods are heavier than others, some stronger, and some more ornate and decorative. All the wood that goes into a guitar is designed to make the guitar sound good as well as make the instrument look beautiful. Woods that reflect a lot of vibrations usually make bright sound, while woods that absorb vibration tend to produce darker and duller sounds.



Woods from luthier John Currier's workshop: mahogany, rosewood, blood wood, and ebony.

A guitar is made up of different woods to create different tones. The most common woods used by luthiers include:

Spruce is one of the best woods for projecting sound. It is often used for the top of the guitar, called the soundboard, where most of the string vibrations are projected into the air. Spruce is soft and lightweight, but very stiff. This stiffness makes spruce bounce the sound rather than absorb it. It creates a very bright sound.

Spruce trees are evergreens that grow in cold climates. Because of its strength and light weight, spruce was used by the Wright Brothers to make their first airplane. Spruce is also used to make paper. The oldest tree in the world is a spruce in Sweden that is estimated to be 9,550 years old.

Rosewood is a unique wood that has both good projection and good absorption qualities. It is used on the sides of the guitar to project low- and medium-pitched tones. Rosewood is naturally very oily, which causes it to absorb certain tones.

Because rosewood is great for creating rich guitar sounds, it has been used for more than a century to produce guitars. However, Brazilian rosewood, which comes from the Amazon rain forest, has been overharvested and has almost completely disappeared. It is now an endangered wood, so no new Brazilian rosewood can be harvested. Luthiers are using relatives of this tree, like Indian rosewood, to make new guitars.

Mahogany is harder than spruce, but lighter than some other woods. It doesn't vibrate like spruce, so it is generally used on the sides or backs of guitars, where it produces a sound that is warmer and not so bright. It is regularly used in block form for bodies of many electric guitars.

Mahogany trees grow in tropical regions, primarily in Central America and South America, and yield a very popular wood for furniture.

Maple is a very hard wood that is frequently used for guitar necks. Its hardness keeps the neck from vibrating and also helps it stay rigid against the pull of strings. Maple is sometimes used for electric guitar bodies, especially because it can have unusual grain patterns that are decorative.

There are over 100 species of maple trees; they typically grow in areas above the equator, in North America, Europe, and parts of Asia. Maple trees are used for everything from producing syrup to making baseball bats.

Plywood is an inexpensive wood created from pasting layers of thin wood sheets together. These sheets usually come from spruce, pine, or fir trees. Plywood is typically used for construction, although some products, including low-cost acoustic guitars, are made from plywood, even though plywood has no significant tonal properties.

Constructing an Acoustic Guitar

The body of an acoustic guitar is built like a box. It has a top, bottom, and sides. The entire body is usually made of wood that is almost as thin as cardboard. The wood is thin so that energy from the vibrating strings can bounce off it; thin wood also keeps the guitar light and easy to carry around. When strings are pulled across the top of a guitar, they exert almost 200 pounds of tension on the guitar. That's almost like having a large man standing on the wood. In order to keep the wood from breaking, the inside of a guitar is built like a skeleton. Thin pieces of wood are attached all around the inside. These pieces of wood, called braces, are placed in spots where the stress is greatest; they help keep the wood sturdy.



Stevens Point Luthier John Currier uses a hand planer to shape a brace for a guitar body.

Braces are very important in building the guitar (and many other stringed instruments). The braces cannot be too stiff or the guitar body won't vibrate enough to project sound and will have a dull tone. If the braces are too weak, the body will eventually warp and possibly break.

One of the things that makes the construction of an acoustic guitar so impressive is that there are no nails or screws used in the body. Everything is held together with only glue. That's because nails and screws can't completely seal the body — there would be empty spaces between where nails and screws are inserted. Empty spaces would cause the guitar body to rattle. The glue is reinforced by snakelike wood strips called kerfing, which are easy to bend and twist because they have notches cut into them. Once glued, the kerfing becomes just as strong as solid wood.

The iconic curved body of the acoustic guitar is a product of its curved sides, which are created by bending thin strips of wood. Even though the sides are thin, it is hard to bend them in an "S" shape without snapping the wood. For this reason, the wood is soaked in water and heated using a bending iron. This steam heating makes the fibers in the wood surprisingly flexible; this is because water molecules bind with wood molecules and make them "slippery." Even a thick piece of wood can be bent if it is steamed sufficiently. Boats, barrels, and furniture use this technique. The wood is bent into shape and held in place using molds and clamps. Once it dries out and cools, the wood keeps the "S" shape and is glued into place.

Sound from Strings

Strings are the part of the guitar that create sound. The vibrations of strings are projected into the air by the top – the soundboard – of the guitar.

Different kinds of strings create different sounds. Thicker strings make lower tones, while thin strings make higher pitched tones.

There are three categories of guitar strings, each having to do with the material the string is made of: catgut, steel/metal, and nylon.

Catgut

For most of recorded history, right up until the mid-1900s, musical instrument strings were made primarily from "catgut." It had nothing to do with cats, but it did have a lot to do with guts. The strings were actually dried sheep intestines (although they occasionally came from other farm animals). The intestines went through various cleanings and treatments to create smooth yet strong strings for everything from lutes and violins to cellos and guitars. Gut also has been used as medical sutures to stitch up wounds and as strings for tennis racquets. No one knows how the word "catgut" came into being. It may have been a derivation of "cattlegut," meaning the intestines of farm or ranch animals. Or it may originally have been called "kitgut," meaning the gut strings attached to a *kithara*. In any event, there aren't any cat parts in catgut.

Steel

Metal strings made out of steel and bronze were first used on guitars around 1890. The popularity and loudness of the mandolin and banjo, which both used steel strings, encouraged many players to replace their gut strings with steel. The problem was that steel strings exerted more tension on the guitar's body than gut and often ripped the instrument in half. It wasn't until

better bracing, created by the Martin family, that steel strings would be used regularly on guitars. Ultimately, steel strings were cheaper and lasted longer than gut.

Steel strings became used even more frequently during the two World Wars, when other materials were scarce (copper pennies were even made of steel for a period of time). Steel strings were also louder (their strength vibrated the guitar's top more than nylon or gut), made more pitch changes when bent slightly, and also responded well to the use of a metal or glass slide.

Heavy steel strings are made of two parts. A core wire is wrapped from top to bottom with another wire, adding thickness and strength to the string. This configuration also helps create a warmer tone for these strings than that produced by a lone wire. Usually the bottom three strings of a guitar, and occasionally the fourth, are wound strings. Electric bass strings are always wound.

Nylon

For guitarists who played classical or flamenco guitar, steel was not an option to replace catgut. It was too loud and brash to allow for the subtleties of those musical styles. Yet gut tended to wear out quickly and was expensive. With the creation of nylon and other plastics in the 1930s and 1940s, natural and hard-to-find materials were replaced in many areas of daily life. Tortoise shell combs were made of nylon, parachutes and carpets were made of nylon, and ultimately the catgut used for guitars strings and tennis rackets was replaced by nylon.

In 1946, Andres Segovia – the man credited with popularizing the classical guitar all over the world – worked with a luthier named Albert Augustine to create a nylon string with all the tonal properties of gut, but that would be stronger, easier to tune, and last longer (a fear of many performing classical guitarists was the possibility of a gut string breaking during a recital). Augustine used cables of thick nylon thread from the DuPont company to craft strings that would be suitable for Segovia. With Segovia's blessing, nylon became the standard for guitar strings on classical and flamenco guitars, as well as for smaller, introductory guitars for kids. Like steel strings, the heaviest nylon strings are wound for better sound and strength.

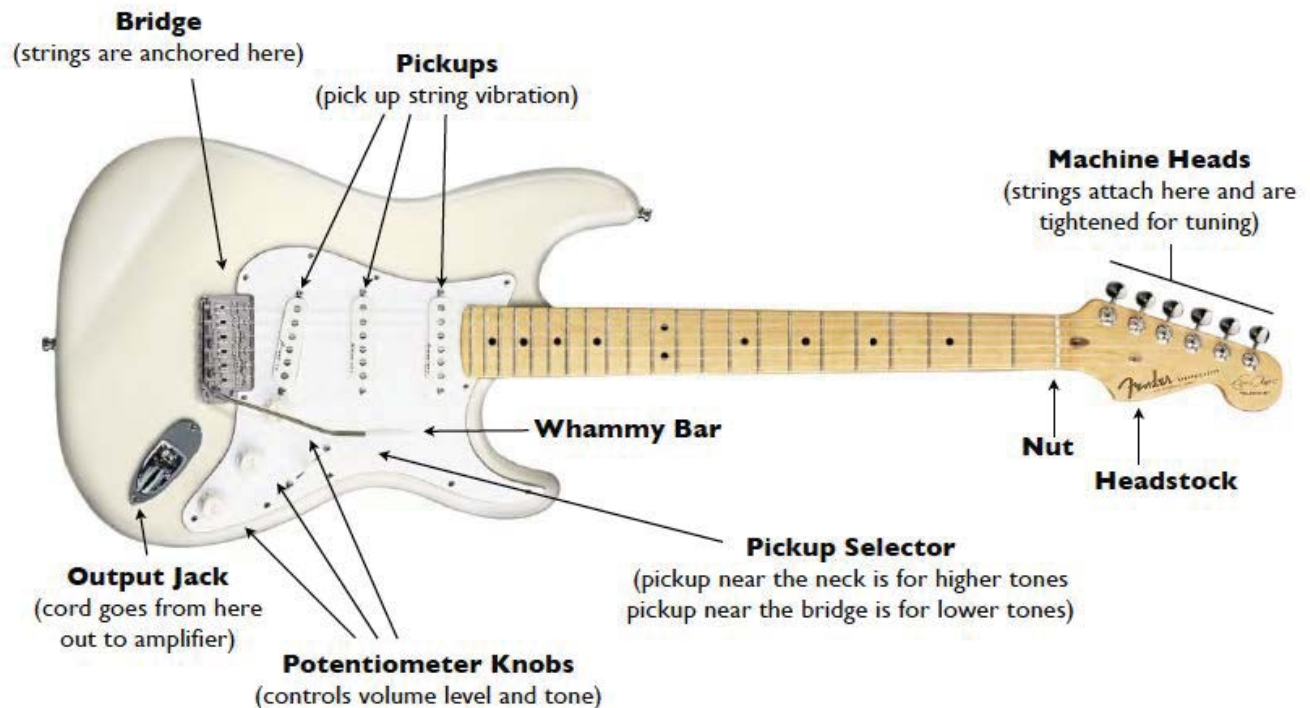
Some manufacturers still make gut strings in limited quantities, but these strings are almost 10 times more expensive than nylon.



Left: *Baroque Guitar*, ca. 1600, unknown designer – originally from Iberia, commissioned reproduction
Right: *Warlock Red*, 2001, design by Bernardo Rico, manufactured by B.C. Rich

Solid Bodies – Understanding Electric Guitars

An electric guitar is a simple device that relies on electromagnetism to produce sound. In the guitar below, you can see how each of the three magnetic pickups is wrapped in copper wire.



When the magnetic field of the pickup is disrupted by the vibration of a metal string, it creates a current in the copper wire. This current, or signal, is then transmitted through another wire to devices called potentiometers. These potentiometers, which are controlled by knobs, adjust the frequencies in the signals that control volume and tone — just like a dimmer switch adjusts the level of light from a bulb. The signal then leaves the guitar through the output jack, which is where a cord is plugged in that leads to an amplifier.

The rest of the guitar is made up of metal screws, metal bridge pieces, plastic knobs, metal tuners, plastic pickguard, metal springs to control the tension of the bridge when a whammy bar is used, and metal wire for the frets.

Pickups

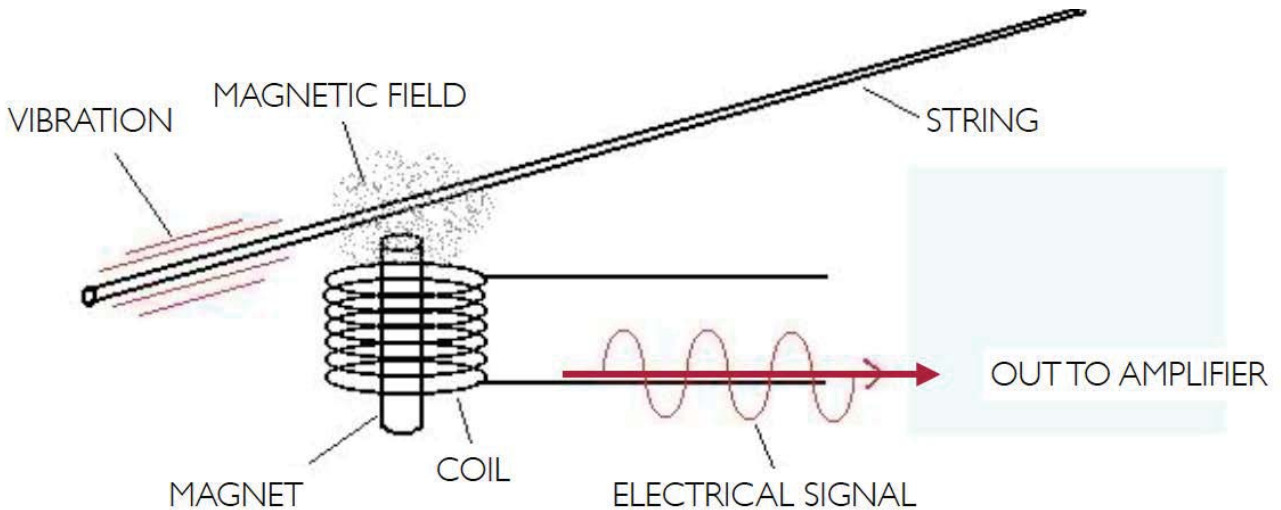
Pickups are small magnetic devices. At the heart of the pickup is a magnet. Wrapped around this magnet is very thin copper wire. Together, the magnet and the wire form a magnetic field that can send electrical signals. But one thin strand of wire doesn't make for a strong signal, so there are usually 5,000 or more loops of wire (called turns) wrapped around a pickup. With that many turns, the pickup is strong enough to send a signal.

So where does that signal come from? Well, an electromagnet only produces signals when its magnetic field is disrupted by something in motion. In the case of pickups, the metal guitar string vibrates over the pickup, causing a disturbance in the magnetic field surrounding the magnet and

copper wire. The magnetic field creates an electrical signal that matches the vibrations caused by the string vibrations. Basically, it translates the mechanical signal into an electrical signal, which is then sent via a wire out to the other electronic parts of the guitar, including its volume and tone controls.

As soon as the string stops vibrating, the electromagnetic pickup goes back to rest and doesn't send any more signals until the string is plucked again.

Most pickups have magnetic poles that are designed to pick up the vibrations from a single string.



These can't be too strong or they can actually start pulling magnetically on the strings, preventing them from vibrating freely.

Before Your Visit

- *Sample the galleries* using the Woodson Art Museum's audio tour app with insights from guitar historian and performer Michael Kudirka. The *Medieval to Metal* audio tour includes sounds and stories from twelve different instruments on view ranging from ancient predecessors to the guitar such as the *oud* to contemporary edgy metal electric instruments like the B.C. Rich Warlock.
- *Enjoy a performance* from a rock n' roll legend like Chuck Berry with the help of Youtube to introduce students to the range of sounds and legendary artists associated with this instrument. The Zlozower photographs feature a range of performers and music genres for students to explore while observing the types of guitars cherished by these players – many of which are on view in the exhibition.

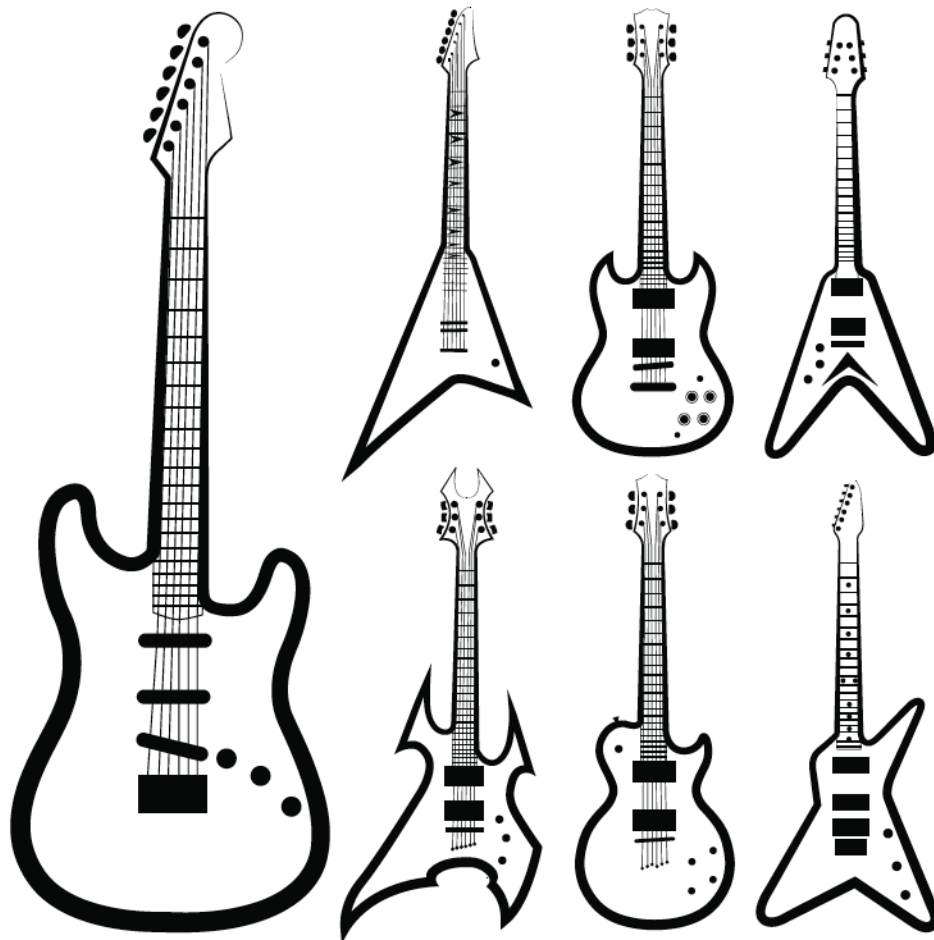
@ the Woodson

During your visit to the Woodson Art Museum, a docent will lead your group through the galleries offering insights and encouraging thoughtful dialogue inspired by the guitars and photographs on view. All docent-led Art Museum Experiences involve opportunities for hands-on art making for students. Following their guided gallery Experience, students are invited to

sketch their own custom guitar design using drafting tools and large paper in the galleries. Luthiers often utilize compasses, rulers, stencils, and more to tweak and revisit guitar design templates and adaptations for custom instruments.

As they work, docents will prompt students to consider the following:

- How will they account for and incorporate the essentials of the guitar, such as the fret board, pegs, bridge, etc.
- What style of music or type of artist is going to use this guitar? How could the design be tailored to suit a performer's personality?
- If students could make one ergonomic adjustment or addition to their guitar, can they think of a way to incorporate it aesthetically?



Students will be encouraged to color and add to their designs at home or back in the classroom. Consider asking students to present their design concepts and modifications to their peers for feedback and questions.

Activity Guides

Each participant on a docent-led Experience receives an Activity Guide to extend learning and enrichment beyond the Museum and as a way to share the visit with friends and family.

Woodson Art Museum Information

Please encourage your students to visit the Museum again. Admission is ALWAYS free.

Hours:

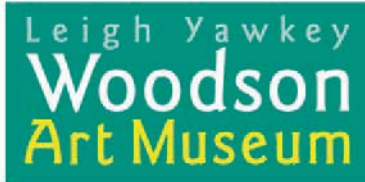
Tuesday – Friday 9 am – 4 pm
First Thursday of each month 9 am – 7:30 pm
All March & April Thursdays 9 am – 7:30 pm
Saturday – Sunday Noon – 5 pm
Closed Monday and holidays, including Easter

On the first Thursday of every month – Night Out @ the Woodson – the Museum remains open until 7:30 pm offers hands-on art for all ages from 5:30 – 7 pm.

Contact:

Call the Woodson Art Museum or visit the website for more information:

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Wausau, WI 54403
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Medieval to Metal: The Art & Evolution of the Guitar
is a touring exhibition of The National Guitar Museum.