



Exhibit message

The pentaphones demonstrate ‘timbre’ or tonal quality as well as the F major pentatonic scale.

Quick Fact

Xylophones are percussion instruments that you strike or hit, like a drum. This is indicated by the ‘-ophone’ suffix in an instrument’s name.

The prefix xylo- actually means ‘wooden’. So technically, if you are playing a metal xylophone, you should call it a metallophone!

Because drums have a stretched skin or membrane, they could be called membranophones.

Lithophones are xylophones or chimes made of resonant stone slabs. The oldest stone chimes are Chinese *bianqing* believed to be more than 4000 years old.

Graphic panel text

These pentaphones are made from glass, aluminium, wood, brass and plastic.

The same note on each pentaphone may sound different (maybe ‘warm’ or ‘dull’) in their sound quality.

This difference in sound quality is called **timbre** (“tom-ber”).

An instrument’s timbre is affected by:

- its shape
- how it’s played and
- the material from which it is made.

That’s because instruments make sounds by vibrating, so the different materials and shapes vibrate in different ways.

Musicians use groups of notes called **scales** to compose music.

Major scales are usually found in classical symphonies and rock songs.

The notes you play on the pentaphones make up a **pentatonic scale**. This scale is often used by blues musicians.

Want to know more about timbre?

When you listen to a symphony, you can identify different instruments.

Even similar instruments such as a clarinet and an oboe playing the same note at the same volume sound different.

This is because instruments are made of different materials that affect the personality of their ‘voice’.

An instrument’s voice, known as **timbre** is also affected by its shape and how it’s played.

Instruments make sounds by vibrating and different materials vibrate in different ways.

In the *Pentaphone* exhibit, each set of bars is made of a different material such as wood, glass, aluminium, brass, and plastic, each with a unique voice.

Sounds have characteristic pitch (high or low note), loudness (a soft or loud volume), and sound ‘quality’.

Sound quality or timbre describes whether different sounds of the same pitch and loudness can be distinguished by how they sound (maybe clunky, tinny, soft, wooden, etc).

Timbre is mainly determined by the harmonic content of a sound and its vibrato.

Musicians usually use groups of notes called **scales** when they compose music.

There are many different kinds of scales. One type, the major scale, is commonly found in classical symphonies, rock songs, and other Western styles of music and usually contains eight notes. You may know the major scale from the song “do re mi.”

The notes you play on the *Pentaphone* exhibit make up another scale, known as a **pentatonic scale**.

This scale uses five notes, usually C, D, E, G, A, while the Pentaphone exhibit contains A, C, D, F, G and A.

Blues musicians and folk music commonly use notes from a pentatonic scale.

Extra for experts

Timbre is more complex than pitch or loudness, which can each be represented by a one-dimensional scale (high–low for pitch, loud–soft for loudness).

While pitch and volume are important for expressing emotion in a musical piece, timbre is also important.

The sound quality or timbre of a musical instrument is mostly determined by **harmonic content, attack and decay, and vibrato**.

When a musical note is held (or sustained), its harmonic content affects its timbre the most.

Vibrato is the periodic change in the pitch (or vibration frequency) of a tone. Vibrato is often used by singers to add expression and richness to the voice.

Tremolo is the periodic change in the amplitude (or loudness) of a tone.

Early attempts to synthesise sounds on a computer tried to produce right harmonic mixture, but they still sounded electronic.

If a computer tries to reproduce a sustained note from a voice or wind instrument, the human ear can detect that it is an unnatural sound.

To make the computerised sound more realistic, some type of vibrato or tremolo needs to be added to the synthesised sound.

This is because in live musical performances, the notes are not steady and continuous but tend to start, stop, grow louder and softer.

When sound is analysed on an oscilloscope, the sound wave frequencies or spectrum can be studied.

The wave range or spectrum of harmonic frequencies in a note can be seen on an oscilloscope. These different frequencies give a note its tremolo.

It may take about 60 milliseconds for humans to recognise the timbre of a tone, and any tone sounded for less than 4 milliseconds is perceived as an atonal click by humans.

Some musical sound sources have overtones which are not harmonics of the fundamental.

It is suggested that it takes about a 4 dB change in mid or high harmonics to be perceived as a change in timbre, whereas about 10 dB of change in one of the lower harmonics is required.

Pentatonic scales use five pitches or notes to fit into an eight note octave range. So, from middle C to high C, a simple, major pentatonic scale uses the five notes C, G, D, A and E.

Pentatonic scales always contain five notes, but they can become major or minor pentatonic scales, depending on how the notes progress.

Minor pentatonic scales use similar notes to major pentatonic scales, but their notes are one step lower to obtain the tonic note.

So, a C minor pentatonic scale (based on C major pentatonic scale) would be C, E flat, F, G, B flat.

An A minor pentatonic scale is A, C, D, E, G. A.

The major pentatonic scale can also be seen as all the pitches that are *not* present in the major scale.

In C major, the remaining pitches are G flat, A flat, B flat, D flat, and E flat, the notes in the G flat major pentatonic scale. These notes are also the black keys on the piano keyboard.

Pentatonic scales tend to differ in Asian and Western music.

The pentatonic scale in Asian music tends to replace the 'C' with a 'B' note.

The composer Debussy was exposed to the Indonesian gamelan (using a pentatonic scale) at the 1889 Paris Exhibition. This may have influenced him to write music using the pentatonic scale.

Further information

- ✪ BBC Music – how to change pitch, timbre on an instrument
<http://www.bbc.co.uk/schools/gcsebitesize/music/classicalorchestral/romanticrev3.shtml>
- ✪ Exploratorium pentaphone
<http://www.exploratorium.edu/xref/exhibits/pentaphone.html>
- ✪ Hyperphysics <http://hyperphysics.phy-astr.gsu.edu/hbase/sound/timbre.html#c2>
- ✪ MadSci Network How is Musical Timbre Perceived?
<http://www.madsci.org/posts/archives/jul2000/962887826.Ns.r.html>
- ✪ Teaching Timbre: An Empirical Approach to Music
<http://music.utsa.edu/tdml/conf-VI/VI-Hajde/VI-Hajde.html>
- ✪ Oxford University Press Grove Music Online <http://www.grovemusic.com>