A SYMPHONY OF SOUND

THE SCIENCE BEHIND SOUND

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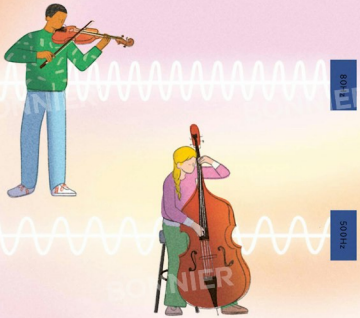
HIGH AND LOW

When we sing "*Happy Birthday to You*", we make the **pitch** of the musical notes go up and down to create the tune. Pitch also helps us work out what is making a sound. A mouse makes a high-pitched squeak, while a lion makes a low-pitched roar. Knowing the difference is important for survival, because if it's a lion, it's time to run away!



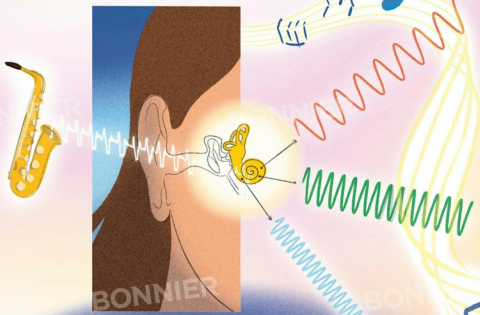
PITCH AND FREQUENCY

Low-pitched sounds are usually made by larger things, and high-pitched sounds by smaller things. So *Happy Birthday* sounds lower on the larger double bass than on the smaller violin.

When scientists measure sound, they measure the **frequency** of the note. They do this by counting the number of vibrations per second. Frequency is measured in Hertz (Hz). Because the violin has a higher pitch, it has a higher frequency sound wave. Whereas the double bass will have a lower pitch, and therefore a lower frequency sound wave.

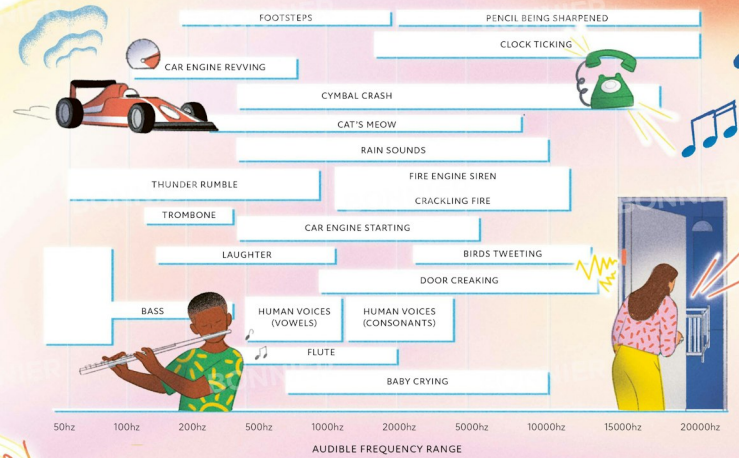
TIMBRE

If two instruments play the same note with the same pitch, they sound different. Musicians talk about each instrument having a unique **timbre**. What your brain hears as a single note is really a mixture of sounds. It's a bit like a cake, which we might think of as one thing, but is actually made up of flour, butter, eggs and sugar. Similarly, a musical note is a mixture of sounds at different frequencies, which make up the timbre. When you listen to a sound, the **cochlea** in your inner ear separates each note into its components, and this helps the brain work out what instrument is playing.



AUDIBLE FREQUENCY RANGE

A young person can usually hear sounds ranging in frequency from **20 Hertz** to **20,000 Hertz**. This is the audible frequency range. Most everyday sounds only use a part of this range.



AUDIBLE FREQUENCY RANGE

SPEAKING WITH FEELING

As we talk the **pitch** of our voice will naturally go up and down. Try speaking this sentence aloud with every word having the same pitch and you'll notice it sounds odd and boring. Varying the pitch helps us to communicate in lots of ways. For example, ask someone a question, and the pitch of your voice will probably rise at the end of the sentence. This tells the listener that you have something you want answering.

SCIENTIFICALLY SPEAKING

A child typically says its first words when it is between 10 and 14 months old, and by the age of 5, they usually know a thousand different words. Because this happens very naturally for most children, speaking can seem like a very simple skill. In reality, however, speaking is a really challenging thing to , as it requires the precise control of about a hundred fast-moving muscles.

HOW A VOWEL SOUND IS MADE

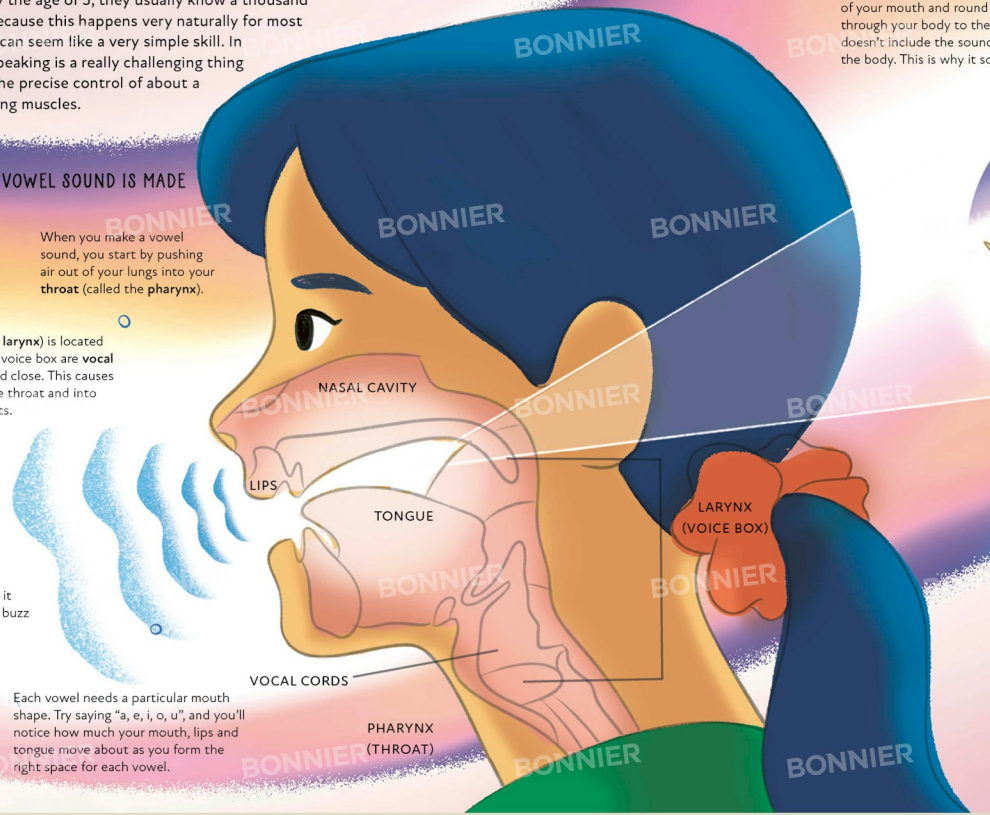
When you make a vowel sound, you start by pushing air out of your lungs into your **throat** (called the **pharynx**).

You **voice box** (called the **larynx**) is located in the throat. Inside your voice box are **vocal cords** which flap open and close. This causes the air to come out of the throat and into your mouth in short bursts.

You can feel your vocal cords vibrating if you put your hand on your throat while talking.

At the vocal cords, it sounds more like a buzz than a vowel.

Each vowel needs a particular mouth shape. Try saying "a, e, i, o, u", and you'll notice how much your mouth, lips and tongue move about as you form the right space for each vowel.



WHY DO SOME PEOPLE HATE HEARING A RECORDING OF THEIR OWN VOICE?

A recording of your voice sounds very different to what you hear as you talk. When you talk, you hear both the **sound** coming out of your mouth and round to the ear, and **vibrations** that pass through your body to the inner ear. A recording of your voice doesn't include the sound of the vibrations passing through the body. This is why it sounds wrong when we hear it.

SOUND BITE

The **pitch** of someone's voice comes from how fast their vocal cords open and close as they speak. A child typically opens and closes their vocal folds around 260 times a second, producing a frequency of 260 Hz.

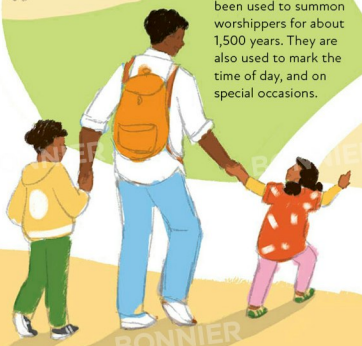
For a woman, the pitch is around 220 Hz, and for a man, it's around 120 Hz. Men have lower pitched voices than women and children because their vocal cords are longer and thicker, and so open and close slower.

A SOUND WALK

When we're out and about, we're often chatting to friends, sitting in a car, or listening to music on headphones. We see the world around us, but we barely hear it. A sound walk is a simple way to explore what we're missing. Try walking around your neighbourhood in silence and tuning into the different the sounds around you. Notice how the sounds change as you move through different areas, and how they make you feel.

Birdsong can help reduce stress and anxiety, and improve focus. How many different birds can you hear?

Church bells have been used to summon worshippers for about 1,500 years. They are also used to mark the time of day, and on special occasions.



Jack hammers can damage hearing, so construction workers need to wear hearing protection.

Notice how the sound of **footsteps in a subway** changes as they move through the tunnel.

The sound of a **street musician** can make you want to dance around or roll your eyes, depending on your personal music taste!

Tree branches creak and leaves rustle in the wind. Tree songs change depending on the leaf types and wind speed.

Car noise may be a familiar sound, but over long periods it can create stress and even damage health.

People chatting in café might make you smile because humans like to socialize and spend time with each other.

Large **fountains** can help hide unwanted sound, like cars. Small fountains create a soothing, trickling sound that reduces stress.

Children playing in a park or playground creates sounds of laughter and squealing. It might remind you of some playful memories of your own.

Depending on who's listening, a **barking dog** can sound friendly or threatening.

Sound walking was popularised by Canadian composer and environmentalist Murray Schafer in the 1970s. He saw it as a way for people to connect to the sounds around them and become more aware of the problems created by noise pollution.