

A graphic at the top of the cover features a wavy yellow staff with several blue musical notes, including a treble clef, a sharp sign, and a triplet. The background is a soft gradient of orange, pink, and yellow.

A SYMPHONY OF SOUND

THE SCIENCE BEHIND SOUND

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COVER
NOT FINAL

WHAT IS SOUND?

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!



HIGH

LOW

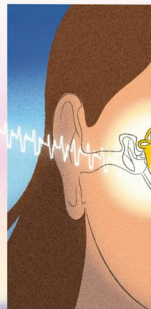
PITCH AND FREQUENCY

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

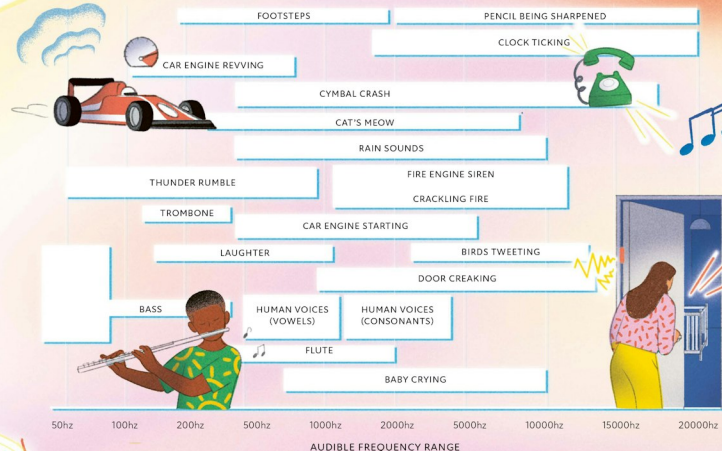
If two instruments play the same note with the same pitch, they sound different. Musicians talk about each instrument having a unique **timbre**. What your brain hears as a single note is really a mixture of sounds. It's a bit like a cake, which we might think of as one thing, but is actually made up 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.



WHAT IS SOUND?

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.



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.

